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Sustainable production, distribution and use of energy: trends in national implementation

Report of the Secretary-General

Contents

		Paragraphs	Page
	Introduction	1–8	3
I.	Regional overview: progress towards sustainable energy	9–26	3
	A. Regional trends in energy production, distribution and consumption	9–17	3
	B. Regional overview of energy strategies, policies and programmes	18–26	5
II.	National implementation	27–134	6
	A. Eastern Europe and the Commonwealth of Independent States	27–38	6
	B. Western Europe	39–50	9
	C. Northern Africa	51–62	13
	D. Southern Africa	63–74	16
	E. North America	75–86	18
	F. Latin America and the Caribbean	87–98	19
	G. Western Asia and the Middle East	99–110	22
	H. Eastern Asia	111–122	25
	I. Oceania and the Pacific	123–134	28

* E/CN.17/2001/1.

01-24676 (E) 120301

III. Challenges for the energy future 135–154 30

A. Regionally recognized environmental problems 135–144 30

B. Regionally recognized barriers against sustainable energy 145–154 30

Annex

Summary of findings 32

Introduction

1. At the nineteenth special session of the General Assembly held in 1997, Governments agreed on the crucial need for sustainable patterns of production, distribution and consumption of energy, and decided that the Commission on Sustainable Development at its ninth session should contribute to a sustainable energy future.

2. In its decisions 7/5 of 30 April 1999,[1] and 6/5 of 1 May 1998,[2] the Commission requested the Secretariat to process and compile the information provided by Governments on the implementation of Agenda 21[3] and requested the task managers of the sectoral areas to make more comprehensive use of that information in the preparation of the reports to the Commission at its future sessions, in accordance with the issues outlined in the multi-year programme of work of the Commission, 1998-2002.[4] The present report on sustainable production, distribution and use of energy is submitted in accordance with those decisions.

3. This report is based entirely on the national information submitted by 78 States Members of the United Nations and Switzerland to the Commission. As of 25 January 2001, 24 national reports for the ninth session of the Commission had been received by the Division for Sustainable Development of the United Nations Secretariat, and their content has been reflected in this report.

4. The report consists of four sections: an overall assessment of the progress made towards sustainable production, distribution and use of energy by region; a review of national implementation and regional trends; a summary of findings from the national information; and a discussion of future challenges for sustainable energy.

5. Section I entitled "Regional overview: progress towards sustainable energy" provides a summary, by geographical region, of the current status of energy production, distribution and use, and explains the most commonly adopted strategies, policies and measures for sustainable energy. It should be noted that the regional summaries are based only on the information provided by the Governments, and that the quality as well as the quantity of information available varies from country to country. Therefore, not all aspects mentioned in the summaries apply equally to each country in the region.

6. Section II entitled "National implementation" discusses the key aspects of energy presented in the national report submitted by each Government. For this purpose, countries have been categorized into nine regional groups, based on their geographical location, which do not necessarily correspond to the commonly adopted categorization from the energy perspective.

7. Section III entitled "Challenges for the energy future" reviews some of the most urgent needs and challenges facing sustainable energy, as commonly recognized by the Governments.

8. The annex entitled "Summary of findings" presents in table form some of the key regional issues related to energy production, distribution and use, as identified and reported by the Governments of the regional groups.

I. Regional overview: progress towards sustainable energy

A. Regional trends in energy production, distribution and consumption

Regional trends in the production, distribution and use of energy, and other significant changes related to energy, based on the national reports submitted to the Commission

Eastern Europe and the Commonwealth of Independent States (CIS)

9. Many countries including the Czech Republic, Hungary and Poland reported significant reductions in coal consumption during the first half of the 1990s. There is a growing use of natural gas in the industrial and housing sectors, along with other renewable energy sources, such as geothermal energy, biomass and hydro energy. Some countries reported reduction of total energy consumption due to economic contraction and implementation of environmental protection measures. Research and development (R&D) activities in the region are centred on the introduction of hydropower, natural gas, biomass, nuclear energy and geothermal energy.

Western Europe

10. All countries in the region reported near 100 per cent accessibility to electricity for urban and rural

households. There has been a recent marginal decline in total energy consumption, except for a few countries such as Belgium. Shares of natural gas use and renewable energy sources are on the rise, in place of coal consumption. Many countries reported reduction of greenhouse gas emissions, and significant improvements in energy efficiency. Countries also reported significant technological advancements, including underground coal gasification, use of biomass, and alternative motor fuels. Nearly all countries reported on institutionalized participation by businesses, consumer groups, experts and non-governmental organizations in the decision-making process. A few countries reported voluntary commitment by industries to cutting energy consumption.

Northern Africa

11. Most sub-Saharan countries in the region reported heavy dependence on fuelwood, followed by petroleum. There is still a need for expansion of the electricity grid for rural households, although overall domestic use of electricity and gas has been increasing. Privatization of the energy sector is at the beginning stage. Some countries have begun to utilize solar or hydro energy, including Burkina Faso and the Gambia. Countries in this region depend heavily on external sources for financing energy projects. Concrete bilateral cooperation, however, has not been specified. Some countries reported cooperation with the United Nations Industrial Development Organization (UNIDO) and the Global Environment Facility (GEF) for energy R&D.

Southern Africa

12. Most countries in the region depend heavily on fuelwood for energy supply, up to 90 per cent in certain countries. Electricity supply in the region varies greatly between countries and regions, although most countries reported the continuing need to expand the electricity grid to rural households. Only one country reported achievements in energy efficiency and reduction of coal emissions. Energy demand is generally on the rise owing to rapid population growth. Most countries depend on outside donor agencies for energy programmes on renewable energy. Private sector participation in energy production is at the beginning stage in certain countries.

North America (information based on only one country)

13. Increases in energy use and greenhouse gas emissions were identified between 1990 and 1998, owing to increased coal consumption for electricity generation, growth in fossil fuel production, and growth in transportation energy consumption. Most industries are making annual energy efficiency improvements of about 12 per cent. A near-universal access to electricity has been achieved.

Latin America and the Caribbean

14. A number of countries including Mexico reported increased use of renewable energy, such as solar and hydropower. There has been an expansion of energy conservation efforts. There is a high potential for further development of hydropower, biomass, solar, wind and biogas for energy. Most countries in the region reported active and regular involvement of major groups in the decision-making process.

Western Asia and the Middle East

15. A number of countries, including Israel, reported increasing energy consumption. Coal is still the major source of energy in some countries including India. Energy consumption and production patterns vary widely in the region, with some countries acting as major importers and others as major exporters of fuel oil. Use of renewable energy sources is also varied.

Eastern Asia

16. A general increase in energy consumption has been reported, owing to industrial expansion and increasing demand from the transport sector. A number of countries reported diversification of energy sources, such as an increased share of natural gas use. Significant technological advancements have been made by a number of countries, in solar batteries, wind power generation, gasification and liquefaction of wood biomass, waste-water treatment, high sugar producing crops, cogeneration systems, natural gas vehicles, fuel cell vehicles, monorail, and light rail transit.

Oceania and the Pacific

17. Australia and New Zealand reported the emergence of an open and competitive energy market, with moderate increase in energy consumption

compared with gross domestic product (GDP) and population growth. Use of renewable resources, especially hydropower, is dominant in New Zealand. Tonga reported growing demand for energy from the residential sector and increasing petroleum import for transportation.

B. Regional overview of energy strategies, policies and programmes

Most commonly implemented strategies, policies or plans towards sustainable energy among the countries that submitted information

Eastern Europe and CIS

18. There has been recent enactment or revision of laws or regulations concerning energy pricing, emission limits, tax measures, and monitoring methods aimed at energy efficiency. Most commonly adopted energy strategies include introduction of renewable energy sources for domestic heating and cooking, and minimizing of energy consumption and pollution. Some countries reported plans for privatization and restructuring of the electricity and gas market. Most countries in the region have implemented measures to reduce greenhouse gas emissions, such as phasing out leaded gasoline and converting from coal to gas in the heating system. Many countries reported plans to expand hydroelectric power generation. One country reported provision of subsidies for low-income households for heat and electricity.

Western Europe

19. All countries in the region reported legislation on specific efficiency standards or regulations for buildings, heating, home appliances, and vehicle emissions, and widespread use of various fiscal incentives such as taxes, exemptions, subsidies and loans to reduce fuel consumption and to promote renewable sources. Most commonly reported energy policy involves liberalization of the energy market, and diversification of energy sources through wider use of renewable energy. Many countries have adopted strategies to control industrial pollution, especially carbon dioxide (CO_2) emissions. Some countries reported plans to introduce a CO_2 tax. Two countries have plans to prohibit the use of nuclear energy. Austria, Belgium and the United Kingdom of Great Britain and Northern Ireland reported provision of financial assistance to low-income households for heating and better access to electricity. Countries in this region have adopted various programmes such as promoting solar and geothermal energy, modern combustion technology, recycling, public transport, electrical cars, R&D of renewable sources and energy conservation, and environmental impact assessment. There is wide use of training programmes, campaigns and information service schemes in the region aimed at promotion of public awareness and capacity-building.

Northern Africa

20. Several countries have enacted new laws dealing with energy-related aspects. Some countries, including Algeria, Benin and the Gambia, reported using taxes as incentives for energy conservation and efficiency. The most commonly adopted energy strategy in the region is to develop and increase the use of biomass, solar, wind and hydro energy. Preservation of the natural resources is another common concern among the reporting countries. Several countries have plans for public awareness-raising programmes, and programmes for improving energy access to urban and rural households and expanding the electrical network, and introducing enhanced gas stoves and solar cookers.

Southern Africa

21. Only one country reported use of emission control guidelines and financial incentives for unleaded gasoline. There is common emphasis on use of renewable energy sources, especially the solar power system, replacing the dominant consumption of fuel wood. A number of countries' priority is providing electricity to rural areas and distributing efficiency-enhanced stoves to urban and rural households. Some countries, including Malawi and Tanzania, reported development of bio-energy technologies, such as using agricultural residues and municipal wastes for energy sources. A number of countries began disseminating energy-related information through workshops, media coverage, and campaigns to promote public awareness on energy conservation and energy efficiency.

North America (information based on only one country)

22. There have been recent changes in the federal tax system to promote energy efficiency and conservation, allowing limited use of government subsidies. A key policy objective is to promote a competitive energy

market that can supply competitively priced energy to future generations. Measures have been taken to reduce vehicle emissions, and improve energy efficiency in buildings, equipment, industry and transportation. There are also market-based initiatives promoting greater use of renewable energy sources.

Latin America and the Caribbean

23. Many countries have commonly adopted an energy policy promoting the use of renewable energy sources. A number of countries reported plans for privatization of the energy supply, increasing competition in the market, and breaking monopoly in energy production. Protecting the environment from inefficient energy consumption has also been cited as a common goal. Countries in the region have implemented such programmes as expanding natural gas infrastructure for cooking and heating; wind, hydro, and solar energy development; and atmospheric pollution control. Most countries reported active promotion of public awareness on energy issues through workshops, campaigns, on-the-job training, and school education.

Western Asia and the Middle East

24. A number of countries including Israel and Lebanon reported implementation of vehicle emission regulations, fuel taxes, and energy efficiency guidelines for buildings. Countries in the region have commonly adopted policies to develop renewable energy technologies, and to ensure better energy supply to all regions. Many countries have adopted programmes to conserve energy sources, especially coal, and to protect the environment. Specific projects include solar water heaters for households, provision of improved cooking stoves, recovering energy from wastes, tapping ocean and solar energy, increasing use of natural gas, and using cleaner fuels for vehicles.

Eastern Asia

25. A number of countries, including Japan, Singapore, the Philippines, and Thailand, employ air pollution regulations, efficiency standards, emission limits, and tax exemptions and deductions to promote energy efficiency and conservation. Commonly adopted energy objectives include further development and use of renewable sources, and diversification of energy supplies. Countries in the region have implemented such programmes as replacing kerosene with gas and electricity, making environmental impact assessment obligatory, photovoltaic power generation, power generation from geothermal steam and hydroenergy, and biogas production from agricultural wastes. Most countries in the region have actively implemented various awareness-raising programmes and campaigns.

Oceania and the Pacific

26. Australia and New Zealand are commonly undertaking reforms in the energy sector to reflect real costs for energy provision, to improve efficiency in delivery of energy services, and to allow competition for new and innovative energy technologies. There are also plans to introduce consumer labelling schemes and to upgrade efficiency standards for buildings and appliances. Tonga's energy priority is to improve electricity accessibility to low-income families and energy supply to remote islands. Countries in the region have commonly adopted measures to reduce vehicle emissions.

II. National implementation

A. Eastern Europe and the Commonwealth of Independent States

27. The following nations have submitted information to the Commission: Albania (1997), Bulgaria (1997), Croatia (1998), the Czech Republic (1997), Hungary (1997), Lithuania (1998), the former Yugoslav Republic of Macedonia (1997, 2000), Poland (1997), Romania (2000), Slovakia (1997 and 2000), Slovenia (1997), Ukraine (1997) and Uzbekistan (1997). Those that have not include Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, the Republic of Moldova, the Russian Federation, Tajikistan, Turkmenistan and Yugoslavia.

Decision-making

28. The former Yugoslav Republic of Macedonia, Romania and Slovakia reported involvement of scientific, groups, academia, non-governmental organizations, and businesses in the decision-making process, through seminars and consultations promoting sustainable energy development. Romania expected an

increased role of the private sector in the electricity, heat and gas sectors.

Legislation and regulations

29. The Czech Republic has established emission limits for the industrial sector and remedial measures for investment in environmental improvements. Hungary has made changes to its tax and price systems related to natural resources, energy and raw materials, in addition to environmental product charges and fines for pollution. The former Yugoslav Republic of Macedonia has a tariff structure system for certain energy types, resolutions establishing general conditions for energy supply, and methodology on pricing certain energy types. Romania and Slovakia have legislated various acts, governmental decisions and orders for controlling air quality, fuel, and emission standards and setting monitoring methodologies. In Slovakia, tax exemption is provided as indirect support for renewable energy source operations. Ukraine has adopted a Law on Energy Saving.

Strategies and Policies

30. Albania's new energy policies target increased use of alternative energies for heating and cooking. Bulgaria's Environmental Strategy is aimed at minimizing energy consumption and flows of pollutants and wastes. Croatia's energy objective is gradual introduction of renewable energy resources and achieving maximum independence from imports. Hungary has launched an Action Plan for Energy Conservation aimed at enforcement of regulations for building construction and energy efficiency regulations for household appliances. The energy policies of the former Yugoslav Republic of Macedonia are directed at increasing the share of natural gas for household consumption, and greater reliance on hydro energy. The objectives of Romania's energy strategy include promotion of renewable resources and market competition, restructuring and privatization of the energy sector, and decreasing air pollution. Slovakia's energy objectives for 2000 include liberalization of the electricity and gas market, reduction of energy demand, development of oil and gas pipeline systems, and increasing the share of renewable energy sources. Slovenia promotes energy-efficient policies and programmes with priorities set on use of safe technologies, rehabilitation and modernization of power systems, development of renewable energy systems, and awareness-raising on fuel efficiency. Uzbekistan's new State energy programme is aimed at using non-traditional types of energy such as wind, solar and water.

Programmes and projects

31. Bulgaria's Pollution Abatement Programme involves technological reconstruction and innovations aimed at phasing out leaded gasoline and conversion of central heating from coal and oil to gas. Croatia has implemented the "Removing Barriers to Implementation of Energy Efficiency Measures" project promoting sustainable energy consumption in households and the business sector. In the Czech Republic, an Air Recovery Programme has been adopted to reduce emissions in large coal-burning power stations. Hungary's Energy Saving Soft Loan Programme is aimed at decreasing greenhouse gas emissions. Poland reported launch of a Programme for the Restructuring and Saving of Heat Energy encompassing the converting of coal to gas in boiler plants, technical improvements for vehicles, and introduction of low-emission fuel. The former Yugoslav Republic of Macedonia plans to implement a National Programme of Energy Saving, construct hydroelectric power plants, introduce natural gas in urban and rural heating systems, and prepare new quality standards for liquid fuels. Romania conducted demonstrative projects under the Phare Programme, replacing oil products with biomass for energy production. The Government provides subsidies to low-income households for heat and electricity. Slovakia has implemented an energy labelling scheme for domestic electric devices, as well as the developing CO_2 Cap and Trade Programme, the SAVE (Specific Actions for Vigorous Energy Efficiency) 2000 Programme and the Demand-Side Management Programme (DSM).

Status

32. Over 90 per cent of Albania's energy production comes from hydropower plants. Coal provides up to 53 per cent of the total energy production in Bulgaria. Croatia imports more than 40 per cent of its total energy supplies, despite large potential for geothermal, solar, wind energy and biomass. The Czech Republic reported a shift in energy production from use of fossil to renewable fuels, and subsequent reduction of

emissions between 1990 and 1994. Hungary reported decrease in coal consumption following the introduction of nuclear energy, which provides about half the electric energy. Lithuania's principal sources of pollutant emissions are the transport, industry and energy sectors. Poland reported an 18 per cent drop of energy consumption during 1991-1995 as a result of energy and environment policies, and marked decrease in hard coal use during the period. The former Yugoslav Republic of Macedonia reported considerable decrease in electricity consumption in industries, and increases in the use of natural gas, hydro and geothermal energy. There is no private sector investment in energy production as yet. Romania imports more than 50 per cent of the oil and gas used. There has been a dramatic drop in emission of polluting substances since 1989 owing to economic contraction and environmental protection measures. Slovakia reported 100 per cent accessibility to electricity, increased use of gas cogeneration and biomass and reduced coal consumption, a rising trend in hydro energy use, and increasing use of geothermal energy. In Ukraine, one of the main sources of air pollution is thermal-electric power stations emitting 32 per cent of the total pollution caused by stationary sources. Almost 70 per cent of the electrical power is obtained by burning fossil fuel at thermal power stations.

Challenges

33. In Bulgaria, about 41 per cent of the total population is threatened by air and water pollution coming from energy, industry and transportation sectors. The Czech Republic reported air pollution as the most serious environmental problem, citing lack of incentives for energy saving and modern technology. Poland reported difficulties in long-term reduction of greenhouse gas emissions owing to rapid economic growth and coal-intensive production. Romania cited gaseous pollutants and dusts as requiring most immediate attention, and mentioned difficulties in attracting foreign investments. Slovakia reported pollution threats from thermal and metallurgy plants, and cited lack of a State budget as the major obstacle to developing renewable energy. The country suffers from the lack of its own primary energy resources, constituting only 11 per cent of total consumption. Ukraine reported outdated technology and absence of recovery facilities for sulphur and nitrogen oxides (NOx).

Capacity-building

34. Hungary's Action Plan for Energy Conservation prescribes information programmes for consumers and local authorities, and training programmes for engineers and managers. Macedonia promotes consumer education on energy-related issues through a "Regional Network for Efficient Use of Energy Resources". Slovakia reported use of exhibitions, various conferences, workshops, seminars, competitions in mass media, and advisory centres to educate consumers and promote public awareness.

Information

35. Slovenia conducts measurements of sulphur dioxide (SO_2) and NOx particles in thermal power plants, ad hoc measurements in industry, and yearly vehicle inspections. Environmental impact assessments are carried out within the energy production sector, as well as environmental audits. In Romania, information on energy is made available to the public through annual reports on the state of the environment, reports of industrial companies, international and domestic conferences and workshops, mass media, and publications. Information on energy is collected by Slovakia's State statistical office and received from businesses, and is then disseminated through web sites, conferences and workshops.

Research and technologies

36. Hungary's research priority is energy-saving technologies. The former Yugoslav Republic of Macedonia constructed new hydro power plants, conducted pilot projects for the use of biomass, and developed technologies for introducing natural gas and renewable sources. Romania reported technological advancements in fuel switching from coal to oil and natural gas, and from carbon to non-carbon fuels. There have been improvements in boiler operations, the turbine cycle, waste heat recovery systems, and use of hydropower, biomass, geothermal and waste-derived fuels. Slovakia reported an increase in hydropower plants, greater use of biomass, solar and geothermal energy, and introduction of nuclear energy. Experiments are carried out on fluid coal combustion, gas-steam units, cogeneration units, and utilization of geothermal energy.

Financing

37. A number of Hungary's energy rationalization programmes and energy efficiency projects are supported by World Bank loans and Germany's coal aid loan programme. The energy programmes of the former Yugoslav Republic of Macedonia are financed by energy enterprises, commercial credits, and grants from other countries. Poland's environment-friendly technologies implementation is financed by the National Fund of Environmental Protection and Water Management. The Bank of Environmental Protection and the EcoFund also provide support for energy saving production technologies and non-conventional renewable energy sources. Romania's energy investments are mainly financed by domestic public sources such as energy companies' funds, the national energy development fund, and the national budget. A small part of investments comes from foreign sources such as the International Bank for Reconstruction and Development (IBRD), the European Bank for Reconstruction and Development (EBRD), the European Union (EU), and the European Investment Bank (EIB). Slovakia's energy programmes are financed by the State budget and private investments. Measures are in place to promote foreign investments.

Cooperation

38. Hungary cooperates bilaterally with the Netherlands on atmospheric issues, with the Norwegian Centre for International Climate and Energy Research on creating long-term energy policy, and with the United States Country Study Programme on energy efficiency. The former Yugoslav Republic of Macedonia receives bilateral contributions from several countries including Austria, the Netherlands and the United States of America to finance its energy projects. Romania reported bilateral cooperation with the Netherlands on power generation aimed at reducing greenhouse gas emission, and with Japan on modernizing two coal mines, a processing plant, and a thermal power plant, financed by Japanese and Polish banks. Romania also cooperates with the EU, Hungary, Bulgaria and the Republic of Moldova for technology transfer. Slovakia reported cooperation with the international energy network UCPITE (the Union for the Coordination of Production and Transmission of Electricity) and CENTREL,[5] the Phare Programme, and SAVE II. It also engages in joint implementation projects with Denmark and the Netherlands concerning climate change.

B. Western Europe

39. The following countries reported to the Commission: Austria (2000), Belgium (1997 and 2000), Denmark (2000), Finland (1998), France (1997), Germany (1998), Greece (1997), Iceland (1998 and 2000), Ireland (1997), Italy (1997), Luxembourg (1997), Monaco (1997), the Netherlands (1997), Norway (1997), Portugal (1997), Spain (1997), Sweden (1998), Switzerland (1997 and 2000), Turkey (1997) and the United Kingdom (1998 and 2000). Those that have not reported include Andorra, Liechtenstein, Malta, and San Marino.

Decision-making

40. Austria, Belgium, France, Greece, and the United Kingdom reported active participation by non-governmental organizations, consumer groups, employers and employees, scientists, and community representatives in the decision-making process concerning the national energy policy. Finland, Germany and Luxembourg reported voluntary commitment by energy-related industries to reducing energy consumption. The Netherlands reported major contributions by major groups in meeting national energy goals, such as the energy-efficient refrigerator prototype developed by Greenpeace Netherlands and "super energy efficient houses" developed by the World Wide Fund for Nature (WWF) Netherlands. Ireland established an Energy Centre to coordinate implementation of the National Energy Conservation Programme and other government policies on energy efficiency, renewable energies and research.

Legislation and regulations

41. Austria, Belgium, Denmark, Finland, France, Monaco and the United Kingdom have legislated efficiency standards for buildings, heating, and hot water supply, limits on vehicle emissions, and labelling regulations for major household appliances. These countries, in addition to Germany, Iceland, Italy, the Netherlands, Norway, Spain and Sweden, have adopted various fiscal incentives to promote energy efficiency, such as a vehicle tax, a fuel consumption tax, and tax exemptions, subsidies or loans to investments in renewable energy sources. Norway and Sweden

reported introduction of a CO_2 tax. In Greece, the Law for the Promotion of Renewable Energy Sources and other instruments regulate energy production and distribution, and promote investments in energy efficiency. In Luxembourg, the Law of August 1993 concerning the rationale use of energy is the key element for a sustainable energy policy. Switzerland's Law of January 1999 provides the basis for a forward-looking and sustainable energy policy. In the United Kingdom, the Energy Saving Trust has been established to raise energy efficiency in the domestic sector, while the Carbon Trust is in preparation for promotion of low-carbon technologies in businesses.

Strategies and policies

42. Austria's energy policies are focused on liberalization of energy markets, diversification of energy sources and suppliers, prohibition of nuclear energy, and price monitoring. Belgium's sustainable energy goals and strategies consist of phasing out nuclear energy, liberalization of the energy market, reducing energy consumption, and introducing a CO_2 tax. Denmark's actions undertaken to reduce CO_2 emission include efficient energy consumption, and changes towards environmentally sound fuel and renewable energy sources. Finland's energy goal is to bring the growth of total energy consumption to a halt in the next 10 to 15 years, and to reduce greenhouse gas emission through commercialization of energy-saving technologies, diversifying options for energy supply, and promoting the competitiveness of bioenergy and other renewable energy sources. Germany's energy policies focus on energy efficiency, environmentally sound and efficient transportation, industrial pollution control, and reducing CO_2 emissions. Greece adopted a National Action Programme for Climate Change, a National Action Plan for the Abatement of CO_2, and a National Action Plan for Energy Conservation. Iceland's energy policy is to further use its domestic energy resources for economic development and diversification, under the goal of accounting for all its energy use from clean and renewable energy sources. Ireland's energy policy is mainly concerned with atmospheric protection, energy efficiency, environmentally sound and efficient transport, and pollution control. Norway's national energy priorities include using more energy-efficient and environmentally safe technologies and environmental impact assessments, and reducing NOx emissions. Portugal has implemented policies to increase diversification and energy efficiency, promote the use of clean technologies, and increase the use of renewable resources. Sweden is actively promoting the spread and innovation of environmentally sound technologies and has developed a national strategy for technical procurement of environmentally sound technologies. Turkey's energy policy focuses on promoting efficiency, environmentally sound transportation, and industrial pollution control. The United Kingdom identified short-term and long-term energy goals as being reducing energy consumption and minimizing waste while achieving a diversity of energy supply, access, and distribution in a free market environment.

Programmes and Projects

43. The Austrian Energy Action Programme promotes the use of solar energy and modern combustion technologies, recycling, public transport, electrical cars, and so forth. Austria, Belgium and the United Kingdom reported provision of financial assistance to low-income households for heating and better access to electricity. Belgium plans to introduce a new National CO_2 Programme by 2001 to meet its CO_2 emission reduction target. Finland has implemented an Energy Audit Programme. Germany's Green Dot System and the Blue Angel Programme promote material efficiency and waste recycling in packaging and other processes. France, in collaboration with 15 other European countries, established the EnR Programme aimed at implementing energy conservation programmes throughout Europe. Greece launched three five-year programmes in 1994, namely, the National Energy Programme promoting renewable energy sources and natural gas, the Research and Technology Programme promoting cooperation between research and producers, and the Energy Operational Programme providing financing to energy efficiency projects. Iceland has undertaken projects to provide electricity to ships in harbours and expand geothermal heating for houses, and to increase carbon sequestration in trees and vegetation. In Luxembourg, the Action Programme on Energy Savings aims at in-depth study of energy issues in communities to better manage energy use and preserve the environment. In Monaco, a waste recycling centre produces large quantities of energy that provides light to public roads as well as heating and air conditioning for new neighbourhoods. The Netherlands engages in voluntary agreements with industries to create efficiency

standards and conduct R&D on renewable energy sources. Norway has implemented "Technology for Reduction of Greenhouse Emissions", energy conservation programmes and indoor climate programmes. Portugal's Incentive System for the Rational Use of Energy provides grants to companies for energy saving activities, such as energy audits, investment and demonstration projects. Switzerland is in the process of elaborating the SwissEnergy Programme, while Turkey plans to implement programmes in technological R&D, public awareness-raising, product labelling, and environmental impact assessment. Ireland has implemented a scheme for Power Purchase Agreements including 34 alternative energy projects, and a competition to secure a 30 megawatt (MW) biomass/waste to energy electricity generating plant. Spain has put in place a Programme on Industrial Technology and the Environment and a Green Line Programme, which provides co-financing and loans. Sweden launched a multibillion dollar programme in 1997 aimed at facilitating the phasing out of nuclear power, and implemented a procurement scheme of energy conserving products. The United Kingdom implemented the Energy Efficiency Best Practice Programme, and the fuel duty escalator programme, among others, to reduce greenhouse gas emissions.

Status

44. Austria, Germany and Sweden reported a decrease in total final energy consumption since 1990, whereas Belgium reported an increase in primary energy consumption. Most countries including Belgium, Luxembourg and the United Kingdom reported an increased share of natural gas and renewable energy sources and a decreased share of coal consumption. Austria, Portugal and Sweden reported substantial improvements in energy efficiency. Finland reported more than a 70 per cent decrease in sulphur emissions since 1985, and a drop of more than 26 per cent in emissions of NO_x since 1980. There was a significant decrease in CO_2 emissions in the 1980s owing to increased use of nuclear power, bioenergy and natural gas, and import of electricity, but a comparable increase in the 1990s. Germany reported a 12.5 per cent drop in CO_2 emissions between 1990 and 1997. Luxembourg depends largely on foreign supply of energy products which amount to 98.5 per cent of imports. Norway reported wide use of hydro-generated electricity, amounting to 99 per cent. Portugal reported the initiation of natural gas use and combined production of heat and electricity. Sweden reported a decrease in energy use in relation to GDP since 1970, indicating disassociation between energy consumption and economic growth. The United Kingdom expects a decline in nuclear energy use over the next 20 years and a small increase in the use of renewable resources.

Challenges

45. Austria reported a need for immediate attention to the transport sector with regard to CO_2 emissions, followed by the residential sector. Major challenges include coordination of energy policies between the federal and State Governments, as well as with EU. A permanent and increasing pressure to reduce public budgets and personnel resources has been cited as a barrier against energy efficiency policy. Belgium cited limited renewable resources, its large centralized energy production system, and low relative price of conventional energies as barriers inhibiting increased production of renewable energy. Setting priorities to make necessary funds available for implementation of environment-friendly policies was mentioned as a major challenge. Greece reported that lack of human capacity, lack of information, and lack of financial resources were, considered the main obstacles to the transfer of environmentally sound technologies. Iceland cited local air pollution, adverse environmental effects and conservation concerns of hydro energy use as major challenges. Norway reported a potential conflict between industry interests and conservation considerations.

Capacity-building and awareness-raising

46. In Austria, State agencies and private organizations provide advice on energy and environment, and also educate workers and advisers in the field. Belgium's regional governments are running information kiosks, training programmes for energy managers in public buildings, schools, and architects, and information systems. Brochures and information packages on energy saving are distributed to secondary schools in Belgium. Finland's Corporate Energy Week is aimed at motivating companies and their personnel to become more aware of the non-governmental organizations rational use of energy. Germany reported joint campaign efforts by the Government, and newspapers such as the "Environmentally Friendly Household" to inform the public of methods to reduce

energy losses in electric appliances. In Greece, training and information dissemination programmes, seminars, and campaigns are being carried out under Energy Conservation in the Built Environment. Iceland cooperates with car importers and the Car Owners Association to publish and disseminate information on car mileage and pollution. Portugal's Strategic Programme for the Dynamization and Modernization of Portuguese Industry provides support schemes for companies involved in environmental protection and energy management, and promotes environmental awareness and information activities. The United Kingdom reported such campaigns as "Are You Doing Your Bit?" and Energy Savings Trust promotions to reduce consumption, and the activities of the Energy and Environment Best Practice Programme providing training to technical staff and researchers dealing with energy-related services. The EcoCal computer programme launched by "Going for Green" helps people to measure the effect of their actions on the environment.

Information

47. Austria reported dissemination of information on energy-related issues to the public by means of personal advice, booklets, brochures and the electronic medium. In Belgium, there are annual publications on energy statistics, semestrial publications on R&D cooperation, daily publication of the rate of oil product consumption through the Web, and federal brochures on the Ozone Plan and the Federal Plan for sustainable development. The Flemish Institute for Technological Research operates the Information System on Energy and Environment, which consists of statistics related to energy and environmental matters, contact databases, and a technology database containing technological and economic information about clean and cost-effective technologies. Belgium, France and Germany reported dissemination of energy-related information through the Internet. Denmark promotes spread of information on energy efficiency through energy labelling of machines and buildings. Germany reported the use of a monitoring system for self-commitment by industry on climate protection, and distribution of 1.5 million copies of the energy-saving book *My Agenda 21*. In Greece, the Centre for Renewable Energy Sources operates a database with information on Greek projects involving organizations and scientists active in the fields of renewable energy sources and the rational use of energy.

Research and technologies

48. Most countries including Austria reported successful development and utilization of renewable resources and plans for continued research and development of renewable energy sources and energy conservation. New technologies being developed in Belgium include underground coal gasification, conversion of coal products and by-products, energy production from biomass and waste, climate-sensitive architecture, passive solar design in buildings, biomethanization of animal products, and solar heating and cooling. Regional governments have introduced alternative motor fuels in public transport with vehicles such as buses on natural gas, hybrid diesel-electric buses, buses on hydrogen, and vehicles on bio-diesel. Denmark provides limited support to R&D of renewable energy such as solar and biomass through energy sector programmes or research grants. Finland reported a successful introduction of energy-efficient technologies such as district heating and combined heat and power. Germany's Energy Research Programme is geared towards reducing consumption of fossil fuel and upgrading the efficiency of energy conversion. High priority is given to rehabilitation and modernization of power systems. Greece has undertaken the "Environmental Energy Map for the Housing Sector", which includes development of a software model for an energy conservation data bank. Iceland authorities sponsored a joint venture to explore possibilities for using hydrogen as fuel for vehicles and fishing ships. A programme sponsored by local authorities in Reykjavik runs vehicles on methane gas collected from a landfill. Norway has established the Centre for Sustainable Production and Consumption to develop, field-test and promote methods that increase eco-effectiveness.

Financing

49. Austria devoted 29 per cent of the total government energy research budget for 1997 to renewable energy development. In Belgium, public sources are used to provide financial support for energy-efficiency equipment in industry, and investment allowances for environmental and energy saving projects. Regional government budgets are used to grant subsidies to promotion of R&D, introduction of new energy-efficient processes, and retrofitting of buildings, as well as to allocate subsidies to hospitals and schools. Private sources, especially from electricity producers, have been used for supply of renewable

energy in grids, wind and hydro installations, and development of solar energy and biomass. Denmark has established the Environment, Peace and Stability Facility to provide support for sustainable energy supply in developing countries. Greece has implemented such financing methods as Technology Performance Financing and Third Party Financing to facilitate energy production and efficiency, as well as transfer and introduction of environment-friendly technologies. Ireland's Energy Audit Grant Scheme provides grants of 40 per cent to energy users in the industrial, institutional and commercial sectors for the hiring of consultants to make energy audits. The Energy Efficient Investment Support Scheme provides grant assistance to energy users within these sectors. In Sweden, environmental taxes such as the CO_2 tax provides a relatively stable income for the public treasury.

Cooperation

50. Austria reported cooperation with the Kyoto Protocol[6] to the United Nations Framework Convention on Climate Change[7] and provision of financial contributions to GEF, as well as bilateral cooperation promoting research and systematic observation and public awareness programmes. Belgium reported cooperation mainly with EU, the International Energy Agency (IEA), GEF and the Kyoto Protocol. It also engages in bilateral cooperation with Hungary, and provides bilateral assistance to Central and Eastern European countries such as Slovakia, the Czech Republic, Slovenia, Croatia, Lithuania, Romania, Ukraine and the Russian Federation. Denmark reported strong commitment towards cooperation with developing countries, providing concentrated bilateral support to 20 such countries as Nepal, the Niger, Burkina Faso, Egypt, Mozambique and Ghana, comprising capacity-building projects, dissemination of improved energy supply promotion of renewable resources, establishment of tax systems, and so on. Denmark also cooperates closely with the World Bank, the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), UNIDO and GEF for worldwide sustainable energy supply. France has energy programmes with countries that are large consumers of coal. Germany reported cooperation with EU on the eco-labelling system, and with the pan-European research and technology scheme EUREKA and its working group PREPARE. Greece reported participation in the Organization for the Promotion of Energy Technology (OPET Network), created under Energy Technology for Our Environment (THERMIE Programme) of the Commission of the European Communities. It also reported cooperation with other EU member States and EU programmes such as the EU non-technological programme on the use of renewable energy sources within EU (ALTENER), SAVE, Joint Opportunities for Unconventional or Long-Term Energy Supply (JOULE)-THERMIE, the International Cooperation Component of the "Energy Framework Programme" (SYNERGY), Technical Assistance for the Commonwealth of Independent States (TACIS), Phare and new policies such as the Euro-Mediterranean partnership (MEDA). Iceland reported cooperation with the United Nations University (UNU) Geothermal Training Programme, aimed at assisting developing countries with geothermal potential to build up specialists for geothermal exploration and development by offering specialized courses. Ireland reported participation in the THERMIE and SAVE programmes, aimed at promoting new technologies for energy efficiency and enhancing the use of alternative energy sources. The United Kingdom has newly planned a Climate Change Programme aimed at meeting its Kyoto Protocol target.

C. Northern Africa

51. The following countries have submitted information to the Commission: Algeria (1997), Benin (1997), Burkina Faso (2000), Cameroon (1997, 2000), Côte d'Ivoire (1997), Egypt (1997), the Gambia (2000), Guinea-Bissau (1997), the Niger (1997), Nigeria (1997), Sao Tome and Principe (2000), Senegal (1997), and Tunisia (1997, 2000). The following countries have not submitted information: Cape Verde, the Central African Republic, Chad, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Ghana, Guinea, Liberia, the Libyan Arab Jamahiriya, Mali, Mauritania, Morocco, Sierra Leone, Somalia, the Sudan, and Togo.

Decision-making

52. Algeria reported involvement of main interested groups such as consumers, producers and households in formulation of the Energy National Policy. The Gambia's Local Environmental Action Plea (LEAP) enables the local government to make decisions on energy-related aspects of atmosphere. In Burkina Faso,

non-governmental organizations, commerce, industry and scientific and technological communities are represented in the National Commission for Energy.

Legislation and regulations

53. Benin imposes taxes on certain energy products. Burkina Faso, Cameroon and Sao Tome and Principe have enacted several laws dealing with energy-related aspects. The Gambia levies an environmental tax on imported and inefficient used cars, and waives the duty on imported solar panels. Special incentives are given to solar energy companies promoting sustainable energy and environmentally sound practices. Nigeria has enacted the Nuclear Safety and Radiation Protection Legislation for safe use of nuclear radiation, while environmental impact assessment laws and guidelines are in place for environmental protection in the exploitation of fossil energy sources.

Strategies and policies

54. Algeria's Energy National Policy is aimed at rational and ecological use of natural resources through establishing economic instruments such as taxation, competitiveness and abolition of subsidies, promoting and developing natural sources of energy, including natural gas, butane and liquefied petroleum gas (LPG), and establishing an awareness-raising programme for the preservation of natural resources and their rational usage. Burkina Faso's energy policy is focused on management of fuelwood, consumer/satisfaction, and diversification of the supply. In Cameroon, the development of hydropower energy is at the core of the national strategy. Egypt reported implementation of policies to improve energy efficiency in all social sectors. Short-term and long-term objectives of the Gambia's energy strategy is to increase energy supply, access, and distribution, introduce energy conservation and efficiency, promote greater use of solar photovoltaic (PV) systems, and strengthen training and research in solar energy. Nigeria's National Energy Policy emphasizes using renewable and alternative energy sources such as wind, solar and biomass, development of environmental assessment methodology, establishing comprehensive waste management programmes, implementing oil spill prevention programmes, and adopting public awareness programmes. Environmental issues have been accorded considerable prominence in Nigeria's policy design for petroleum reserve increase. In Sao Tome and Principe, the main element of the strategy on energy is based on the new sources of energy, such as solar, wind and hydropower.

Programmes and projects

55. Burkina Faso's energy programmes include a regional programme for traditional energies and a national programme for forest management. Cameroon's programmes deal with liberalization, rural electrification and financial mechanisms. The Gambia reported various programmes to enhance energy accessibility to households, including the introduction of independent power production (IPP). Projects are also under way to reduce greenhouse gas emissions, by promoting renewable energy technologies, waiving the duty on solar panels, and promoting improved cooking stoves and solar cookers. The Niger's Programme on Domestic Energy is aimed at promoting use of fuel substitutes. Nigeria has implemented various measures to address environmental problems associated with oil consumption, including environmental impact assessments and an environmental evaluation report, and projects encouraging the utilization of gas. Nigeria is also promoting the use of clean fuels by encouraging a shift from kerosene and wood stoves to gas-fired stoves, and gradually introducing compressed natural gas for vehicles while phasing out leaded gasoline. Senegal has undertaken a Project for Sustainable and Participatory Management of Traditional Substitute Energies to provide regular energy supply for households while preserving the environment. A comprehensive programme on reforming the energy sector is being undertaken. In Tunisia, the Programme of Action "Energy 2010" aims at significant reduction of energy by 2010 while promoting the usage of renewable energies and rationalization of energy use. In Sao Tome and Principe, three main programmes are being established to improve energy access for urban and rural households, expand the electrical network, construct hydropower centres, and conduct firewood reforestation.

Status

56. The Gambia reported suppressed demand for electricity in rural households. Fuelwood accounts for 85 per cent of the total energy consumption, followed by petroleum consumption at 11 per cent. Privatization of energy has just begun. Forests serve as the main source of energy in Guinea-Bissau. Wood, petroleum,

coal, gas and water are the main energy sources in Nigeria. Fossil fuels account for over 90 per cent of the country's export earnings and 80 per cent of government revenues, while oil and gas sector contributes to over 90 per cent of Nigeria's foreign exchange earnings and at least 80 per cent of GDP. In Senegal, use of electricity and gas in households has increased owing to the Government's policy on subsidies and awareness programmes. Nevertheless, charcoal remains the main source of domestic energy in the cities, imposing growing pressure on forestry resources with urbanization.

Challenges

57. Burkina Faso faces several institutional and structural challenges with regard to the use of renewable energy sources, such as high acquisition cost with no acquisition facilities, lack of information regarding the advantages offered by solar energy, psychological resistance by Sahelien consumers, and fiscal and customs measures that do not favour solar equipment over conventional technologies. Cameroon is trying to improve the coordination of its various energy-related activities in the framework of a coherent policy. The Gambia reported a need to ensure greater advocacy for major groups in respect of their making contributions to the decision-making process, and fears of marginalization of indigenous skills due to trade liberalization and privatization. It also reported continuing emissions from diesel power plants, sludge from using heavy fuel oil for power generation, and deforestation caused by the use of fuelwood as major environmental problems associated with energy consumption. Main barriers cited include lack of technical capacity, insufficient finance for energy sources and capital-intense energy projects, and lack of coherent policies. Nigeria reported negative impact of overall energy resource development activities on the environment. Although solar energy and wind energy are abundant, they remain untapped in commercial quantity. The Niger reported that in spite of the positive impact of the Programme on Domestic Energy, technology and capacity-building remain a challenge owing to poor local technologies and lack of knowledge in the rural areas. In Senegal, in spite of the efforts to reform the energy sector, charcoal is still being largely used as a domestic source of energy and therefore exerting a great pressure on forestry resources. In Sao Tome and Principe, reducing the overexploitation and degradation of forestry resources for fuel consumption along with the lack of financial resources remain a big challenge, as well as the lack of expertise by nationals working in the elaboration of energy-related projects.

Capacity-building

58. In Burkina Faso, energy and environment-related topics are included in the school curriculum, under the National Strategy for Environmental Education. The Gambia has planned various capacity-building programmes but funding constraints are affecting their implementation. Programmes to educate consumers on energy and environment-related issues include "Open Days" dedicated to renewable energy, programmes of tours to renewable energy institutions, and the opening to the public of the Gambia Renewable Energy Centre. Nigeria promotes environmental awareness among oil operators and the general public through the Biennial Seminar on the Petroleum Industry and the Nigerian Environment. Oil companies are also encouraged to organize annual Safety, Health and Environment Weeks in their operational areas to sensitize their workforce.

Information

59. Burkina Faso has put in place a database on energy-related issues. A web site is in the works for the public to be able to consult energy-related issues. Cameroon's Centre on Environmental Information and Documentation is responsible for disseminating and creating awareness-raising among the population. The Gambia collects data on energy from surveys and private companies. Such information is to be disseminated through energy bulletins, mass and print media, and web sites. Nigeria reported carrying out environmental baseline studies and establishing oil pollution monitoring stations in high-risk areas. In Sao Tome and Principe, energy-related data are collected along with environmental data; however, its dissemination has been limited to the preparation of the national environmental plan.

Research and technologies

60. Burkina Faso has put in place hydropower and solar energy infrastructure. Cameroon has increased its usage of solar energy, particularly in the rural areas. In Côte d'Ivoire, research programmes undertaken by the Institute of Technology Transformation deal with the transformation of natural products such as coconut, valorization of agricultural residues and dissemination

of village techniques. In the Gambia, all renewable energy companies in solar and wind are private companies, whose activities are monitored by the Government. Hydropower, biomass, or nuclear energy are not available, although there is a high potential for solar energy development. At the local level, improved cooking stoves, solar cookers, solar dryers and biogas are being developed. The Government established the Gambia Renewable Energy Centre for research and development of renewable energy technologies.

Financing

61. In Burkina Faso, the main financial sources for energy are the national budget and donor funding. Private and external financing account for about 90 per cent of the Gambia's energy-related projects. In Sao Tome and Principe, the main source of funding comes from the African Bank for Development.

Cooperation

62. Burkina Faso engages in bilateral cooperation projects aimed at reinforcing institutional capacity in the energy research sector. Gambia reported cooperation with UNIDO and GEF on energy research and development, and participation in the United Nations Framework Convention on Climate Change and the West Africa Power Pool Project. Sao Tome and Principe, in the framework of the United Nations Framework Convention on Climate Change, is negotiating the transfer of energy-related technologies.

D. Southern Africa

63. The following countries have submitted information to the Commission: Botswana (1997), Madagascar (1997), Malawi (1997), South Africa (1998), the United Republic of Tanzania (1997), and Zimbabwe (1997). Those that have not submitted information include: Angola, Burundi, the Comoros, the Congo, the Democratic Republic of the Congo, Gabon, Kenya, Lesotho, Mauritius, Mozambique, Namibia, Rwanda, Seychelles, Swaziland, Uganda and Zambia.

Decision-making

64. In Malawi, the Government and the Malawi Industrial Research and Technical Centre and other associated organizations are mandated to work together on issues concerning the use of biogas, solar energy, the multi-fuel oven using sawdust wood, and *mai-bawo* (an energy-saving stove).

Legislation and regulations

65. Madagascar's Energy Charter stipulates an active use of natural resources and ecological reconstruction of the country, satisfying energy needs within the conditions of a technical rationale, economic efficiency and protection of the natural environment. In South Africa, the Atmospheric Pollution Prevention Act establishes a structure for the control of atmospheric emissions. Unleaded petrol is made available to motorists at a price that is cheaper than that of leaded petrol so as to promote the use of unleaded petrol. South Africa published new guidelines for emissions for the petroleum industry, reducing the allowable concentration by more than 75 per cent between 1993 and 1998. New guidelines are also in place for sulphur in fuel used for refinery heaters and for controlling air quality at power stations.

Strategies and policies

66. Botswana developed an energy master plan that emphasizes non-carbon-based power supplies out of concern for global warming. Of major importance to Malawi is the establishment of kerosene oil depots in places where regular energy supply can be ensured without harming the forests, along with mass production of kerosene stoves throughout the country. South Africa's Draft White Paper on Energy Policy promotes energy efficiency and use of renewable sources of energy. The United Republic of Tanzania's National Energy Policy aims to exploit abundant hydroelectric resources, develop and utilize its natural gas and coal, increase petroleum exploration activities to curb wood fuel depletion, and utilize forest and agricultural residue for power and cooking energy production. Other goals include minimization of energy price fluctuations and development of human resources for development of energy technologies. The United Republic of Tanzania's energy strategies include more efficient use of energy in the transport and industry sectors, rehabilitation of electric power generation and petroleum refining, and development and dissemination of efficient wood fuel conversion and utilization technologies along with simple and affordable kerosene stoves for rural and urban households.

Programmes and projects

67. Botswana launched an Expanded Coal Utilization Programme to provide sustainable alternatives to fuelwood, and the Rural Electrification Programme which emphasizes the use of solar energy for lighting. Malawi reported plans for eco-labelling. Currently under operation are the extension of rural electrification, promotion of biogas technology and energy-efficient stoves. In South Africa, an extensive solar power programme, in combination with an accelerated electrification programme, is making major contributions towards enhancement of the sustainability of rural energy consumption. The accelerated electrification programme targets households in urban as well as rural areas, with the objective of raising the proportion of electrified households to more than 70 per cent by 2000. A low-smoke coal project is in place for the protection of the atmosphere. Also, Green Buildings for Africa has been introduced to promote energy efficiency in buildings. In the United Republic of Tanzania, a Takagas project is in place to reduce emissions of greenhouse gases, substituting bio-energy produced from anaerobic digestion of industrial and municipal waste for fossil fuels. In Zimbabwe, a pilot Solar Photovoltaic Project was implemented with the objective of installing 9,000 systems in rural areas. Also, fuel-saving stoves and alternative sources of energy have been developed to alleviate shortages of energy in rural areas and help combat land degradation.

Status

68. In Botswana, the national electricity grid has reached only the main villages. South Africa reported considerable achievements in energy efficiency in the electricity sector, and a drastic reduction of coal emissions amounting to 91 per cent over 15 years. The United Republic of Tanzania reported a rapidly rising energy demand over recent years owing to population growth. Tanzanian forests supply the bulk of the energy demand, with wood accounting for 90 per cent of the total energy used. In Zimbabwe, up to 55 per cent of urban households are supplied with electricity, compared with 28 per cent in rural areas. The bulk of the remaining households rely on fuelwood.

Challenges

69. Botswana reported extensive dependence on fuelwood, particularly for cooking and heating, causing deforestation around settlements. Malawi reported a need to establish laws controlling and encouraging the use of alternative energy sources that do not contribute to deforestation and greenhouse gas emissions, as well as a need to increase government financing of various energy-related projects. Zimbabwe reported limited success in its rural electrification programme owing to financial constraints.

Capacity-building

70. In Botswana, the Botswana Technology Centre and Rural Industries Innovation Centre are involved in disseminating information on the use of energy-saving techniques and appliances. Malawi reported growing public recognition of workshops, media coverage, waste recycling, and waste reuse initiatives. In South Africa, energy efficiency is being included in school curricula at primary, secondary and tertiary levels as well as in industrial training. A set of energy campaigns, including Enerwise, Moneywise, and Electro-Wise, were launched with the aim of educating, training and informing consumers on energy efficiency. An energy labelling system for refrigerator equipment has also been introduced.

Information

71. Malawi has undertaken surveys in biomass, marketing and urban energy consumption, which would provide baseline data on how much firewood and charcoal are being consumed in major urban areas. In South Africa, energy efficiency market surveys provide information on consumer behaviour and needs. An energy efficiency database is being developed for obtaining data informing benchmarks for awareness and educational campaigns, and a national inventory of greenhouse gases is being drawn up. Publications such as the *Energy Management Newsletter* periodical and *Fuel Consumption of Passenger Vehicles* are intended to inform consumers of new developments and promote fuel efficiency. The United Republic of Tanzania conducted a survey of 20 selected industries to investigate the relationship between production and electricity costs and sensitivity of production costs to changes in electricity tariff. Walk-through audits, semi-detailed audits, and full energy audits for 41 industries have also been implemented.

Research and technologies

72. In Botswana, the Botswana Technology Centre and Rural Industries Innovation Centre are developing

energy-saving and renewable energy technologies, including solar power, wind power and biogas. Malawi took initiatives with GEF and UNDP to establish an Energy Centre. In South Africa, an electricity supplier conducts research into alternative energy sources such as solar, wind, hydro, nuclear, biomass, wave and geothermal. A new type of nuclear technology, the Pebble Bed Nuclear Reactor, is being investigated, and research projects are undertaken on solar, wind and hydro energy. The United Republic of Tanzania is looking into the possibility of retrofitting the thermal power plants to improve their combustion efficiencies, retiring less efficient plants in favour of more efficient ones, changing from industrial diesel oil to natural gas where feasible, and developing renewable energy sources, such as hydro, wind, biomass and solar energy. Zimbabwe is also exploring and promoting alternative sources of energy, such as solar energy and biogas as well as energy-saving devices.

Financing

73. In Malawi, funding for alternative energy programmes has been derived mostly from donor agencies, while the government contribution has been in kind. Renewable Energy for South Africa, a subsidiary of the State-owned Central Energy Fund group, finances renewable energy-based systems for those households that cannot readily be connected to the national grid. Another donor agency, Danish Corporation for Environment and Development (DANCED), set aside 8 million rand for cleaner production projects in selected industrial sectors with the aim of promoting cleaner technology in South Africa. The United Republic of Tanzania reported private participation in investment in the Songo Songo natural gas project, which is seen as a precursor of wider private sector participation in the energy sector. The Takagas project is being funded by GEF and the Danish International Development Agency (DANIDA).

Cooperation

74. Malawi reported cooperation with the Southern African Development Community (SADC) energy management project for industrial energy management, GEF, and the Regional Energy Training Centre which is to be set up. There is a bilateral agreement between South Africa and Germany to collaborate on the promotion of solar cookers in South Africa.

E. North America

75. The following nation has submitted information to the Commission: Canada (1997, 2000). Those that have not submitted information include the United States of America.

Decision-making

76. Canada reported on the division of powers and roles between the federal government and provincial governments, and their coordination by means of consultative and iterative methods. It also identified increasing participation by civilians and municipal governments in the legislative, regulatory, judicial and environment assessment processes, through such mechanisms as the Green Municipal Enabling Fund and the Partners for Climate Protection Programme.

Legislation and regulations

77. Canada reported on recent changes in the federal tax system to promote efforts related to energy efficiency, renewal and conservation, but decreasing and limited use of government subsidies.

Strategies and policies

78. Canada's energy policy objective is to promote a competitive energy sector which can supply competitively priced energy to future generations. Under its First National Climate Change Business Plan, the federal government aims to fine-tune measures and seek partnerships with provincial Governments and stakeholders, to develop and deploy renewable and alternative energy sources, while decreasing emissions.

Programmes

79. Canada reported recent measures to reduce vehicle emissions, such as vehicle inspection and maintenance programmes, vapour pressure limits for gasoline, and implementation of new national vehicle emission standards. Examples include the Motor Vehicle Fuel Efficiency Programme, AutoSmart, FleetWise, and the EnerGuide. The R-2 HOME Programme, the Refrigeration and Intelligent Buildings Programme, the Advanced Combustion Technologies Programme, and the Transportation Energy Technologies Programme are examples of measures undertaken to improve energy efficiency in buildings, in equipment, in industry, and in transportation.

Status

80. Canada reported a 9 per cent increase in energy use between 1990 and 1998, and a 10 per cent increase in greenhouse gas emissions during the period, predicting a 26 per cent excess over the Kyoto target by 2010. Factors affecting emission growth in Canada include increases in coal consumption for electricity generation, growth in fossil fuel production, and increases in transportation energy consumption. Most Canadian industries are making annual energy efficiency improvements of 12 per cent.

Challenges

81. Canada cited the pressure of globalization and industrial restructuring on the federal Government to exercise its responsibilities in a different manner, as well as pressures from the growing population and its export-oriented and resource-dependent economy, as major challenges in reducing greenhouse gas emissions. Canada stressed R&D needs for cleaner fossil fuel techniques.

Capacity-building and awareness-raising

82. Canada reported the use of various educational programmes, information kits, web sites, newspaper and radio advertising, exhibits, community activities, events, and worship to promote public awareness and provide training related to energy-efficient practices.

Research and technologies

83. Canada reported important developments in cleaner fossil fuel technologies, including advanced gas turbines, fuel cells, advanced syngas production technologies, alternative transportation fuels, next-generation power plants and vehicles, and new methods of oil and gas extraction. Research efforts are under way in hydroelectric equipment and facilities, biomass conversion, CO_2 capture and storage methods, alternative transportation fuels, and other cleaner production technologies.

Information

84. Canada reported active management of statistical databases, publications, and web sites related to energy information under the National Energy Use Database Initiative.

Financing

85. Canada has set aside $100 million of the federal budget for four years, starting from 2000, to encourage partnerships with developing countries in reducing greenhouse gas emissions using Canadian technology and know-how.

Cooperation

86. Canada cooperates multilaterally and bilaterally with the Climate Technology Initiative, IEA, EU, the Advisory Panel on Environmental Change (APEC), the Hemispheric Energy Initiative (HEI), the United States, and Mexico on energy policy and R&D issues. Canada's Action Plan 2000 for Climate Change sets out a package of initiatives to reduce greenhouse gas emissions in accordance with the Kyoto Protocol.

F. Latin America and the Caribbean

87. The following nations have submitted information to the Commission: the Bahamas (1997), Barbados (1999), Brazil (1998), Colombia (1997, 2000), Costa Rica (1997), Cuba (1997), Guyana (1998), Mexico (2000) and Venezuela (1997). Those that have not submitted information include: Antigua and Barbuda, Argentina, Belize, Bolivia, Chile, Dominica, the Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, and Uruguay.

Decision-making

88. Barbados reported regular involvement of major groups in energy management, and government consultations with businesses before implementation of new proposals. Brazil reported active interaction between the Government and the academic sector and technical schools which resulted in the formation of qualified professionals and fostering of research in conservation and efficiency improvement in energy production. In Cuba, major groups participate actively in education, dissemination and decision-making in respect of renewable sources of energy. In Colombia, all major groups participate in the energy decision-making process through consultations, public hearings and proposals to the National Congress. The purpose of

Guyana's new Energy Agency is to incorporate various energy-related departments and units under one umbrella, to ensure a more effective and efficient coordination in planning and monitoring of energy matters. In Mexico, most major groups participate in the decision-making process. The Government conducts wide consultations in particular with NGOs, commerce, industry and members of the scientific and technological community.

Legislation and regulations

89. In Cuba, Environmental Law 81 makes provisions for energy resources. Regulations limiting the import of household products have been established. The Bahamas employs a punitive tax system to encourage purchase of more energy-efficient vehicles. In Colombia, an important number of laws and decrees have been passed on energy issues. Mexico's General Law on Ecological Balance and Environmental Protection is the main piece of legislation, while a significant number of laws and norms have also been adopted on energy-related issues.

Strategies and policies

90. The national energy policy of Barbados is geared towards promoting energy conservation practices and use of renewable energy technologies focused on wind, solar, and biomass, and achieving self-sufficiency in oil and gas production. In the Bahamas, priority is given to the rehabilitation and modernization of its power systems and the use of environmental impact assessments. Brazil's new policies for restructuring the energy sector are aimed at breaking monopoly in energy generation, privatizing energy distribution, and increasing competition in production and use of new energy sources. Colombia's Energy-Mining Policy and the National Policy on Clean Production are aimed at optimal use of energy resources, pollution prevention, energy efficiency and conservation, and research and development of clean technologies in fossil fuel, nuclear and renewable energy. Objectives of Costa Rica's National Development Plan include establishing policies and strategies for reliable, timely and competitive pricing of energy supply, and advancing financial schemes to attract investments that will protect the environment. In Cuba, the Development Programme on National Sources of Energy comprises all relevant matters related to sustainable development and energy resources. The National Environmental Strategy also includes indicators on energy and sustainable development. Guyana has formulated a National Energy Policy of which the core idea is the substitution of imported fossil fuels through the promotion and increased use of renewable sources of energy. In Mexico, the National Strategy on Climate Action incorporates specific activities relating to natural resources, industry, energy, urban development, transportation, scientific research and technology, and agriculture aimed at mitigating greenhouse gases. Venezuela's national strategy on energy resources promotes preferential use of gas as a source of fuel.

Programmes

91. Major energy programmes in Barbados include the Schools' Solar Still Programme, the Renewable Energy Project, the Wind Farm Study, and the Development of Renewable Energy Park. Energy projects in Brazil are mainly concentrated in refrigeration and combustion, management of electric energy demand, energy accumulators and hybrid systems, energy conservation, alternative energies, biomass, and artificial intelligence in energy operation. Brazil provides support to projects engaging in clean production, efficient use of conventional energy, and development of renewable energy sources. Colombia's Programme on Gas Encouraging Change consists of extending natural gas infrastructure to the country's main urban centres for cooking and heating. Other programmes include wind and solar energy development and atmospheric pollution control. Costa Rica has undertaken a number of energy-related projects such as photovoltaic electricity projects, expansion of the national electrical system with hydropower and wind plants, commercialization of energy in open markets, and establishing energy indexes to be applied by private industries. Cuba has implemented programmes dedicated to conservation of energy resources, development of hydropower in mountain areas, and electricity savings in the industrial sector. Mexico's Programme on Development and Restructuring of the Energy Sector is aimed at rapid and efficient expansion, and strengthening of public company operations, and energy savings in buildings managed by public administration.

Status

92. Brazil's National Energy Conservation Programme resulted in the decentralization and

expansion of conservation actions and greater efficiency in the use of electric energy. Guyana reported sufficient reserves of renewable energy sources such as hydropower, biomass, solar, wind and biogas. In Mexico, the use of solar energy has been on the increase in rural areas and the trend is expected to continue in areas where electricity is not available. The oil industry is the main source of income for Venezuela. Use of hydropower is expected to increase in the near future owing to increases in fossil fuel prices.

Challenges

93. Barbados reported lack of required technologies to exploit high potentials for wind and solar energy and biofuels resources. It also cited education of field personnel and phasing out of leaded gasoline as future challenges. In Colombia, environmental degradation is caused by atmospheric emissions from the transport and industrial sectors, and use of fuelwood and coal in rural areas. Water contamination is due to the mishandling of toxic wastes from electricity use. Deforestation and loss of biodiversity are directly affected by the use of fuels, coal mining, and transmission and distribution of electricity. Electricity generated by wind and solar energy implies higher risks in the implementing phase. In Mexico, reducing air pollution remains the biggest challenge, particularly in populated urban areas and tourist sites. High interest rates applied by the financial sector remain an important constraint on project implementation where warranties on energy savings and renewable energy resources remain a high risk for lender institutions.

Capacity-building

94. In Barbados, workshops, national consultations, outreach campaigns, and school campaigns serve to educate policy makers and the public on energy issues. Colombia has developed awareness-raising campaigns on energy conservation, and incorporated guidelines on various energy sources and uses in school textbooks. In Costa Rica, the Educational Programme for Energy Conservation aims at developing innovative activities in the area of energy conservation and creating awareness among the various consumer groups, particularly schools and university students. Efforts are undertaken in Guyana to promote energy conservation through public awareness programmes. In Cuba, there are very strong awareness-raising programmes addressed to decision makers to assist them in the formulation of policies regarding sustainable conservation of energy resources and related policy formulation. Campaigns on energy savings are widely disseminated through the mass media and primary schools. In Mexico, extensive dissemination to the population of information on a better environment and the importance of climate change has taken place. There are institutional programmes in both the private and the public sector to support these awareness-raising campaigns in addition to public and private institutes at various educational levels.

Information

95. The Bahamas has undertaken a review of current energy supply and resources. In Barbados, information on petroleum production, supply, import, transformation, consumption and other energy-related activities is provided through the Reference Energy System for Governments by the Caribbean Energy Information System (CEIS). Barbados has also undertaken efforts to develop the National Indicators Programme, which would include indicators for energy resources. Guyana conducts energy audits at various industrial and other enterprises. In Colombia, information on fuel, coal and electrical energy is collected from the supply subsectors. Information regarding the demand is collected through census, polls and studies of the main consumer sectors. Such information is disseminated through the web, newsletters, workshops and seminars. In Mexico, several publications deal with long-term development of the energy sector including the *National State of Energy*, *Forecasts on Natural Gas*, and the *Statistical Compendium* of the energy sector. All such information is made accessible to the public.

Research and technologies

96. Brazil reported technological achievements in the electricity sector, refrigeration systems, lighting, advanced carbonous materials, and thermal-energy performance in buildings. Research and development efforts are under way in the area of renewable energy sources, including feasibility study of using sugar cane for energy generation. In Cuba, electricity generated by sugar cane biomass is competitive. Cuba is continuing to develop technologies for the rational use of renewable resources that would result in competitiveness in the energy market. In Colombia and

Mexico, a good number of projects have been developed utilizing renewable technology in hydropower, biomass, wind and solar energy and, in the case of Mexico, nuclear energy.

Financing

97. The energy sector of Barbados is financed by its national budget and private sector partnership, in addition to assistance from GEF, the secretariat of the Caribbean Community (CARICOM), the Caribbean Development Bank and so forth. Brazil receives funding from GEF, UNDP and so forth for its energy-related R&D projects. Cuba's energy sector is financed by its national budget and the private sector. In Colombia and Mexico, the major financial sources of funding for energy related projects are public and private sources and multilateral institutions.

Cooperation

98. Barbados is party to several international and regional agreements and organizations related to energy, such as the Latin American Energy Organization, the Caribbean Energy Action Programme, and the San Jose agreement. Colombia participates actively in the climate change negotiations and with the Kyoto Protocol, cooperates bilaterally with the Canadian Research Institute on "Assistance to the Mining Sector of Fuels", aimed at strengthening policy implementation and norms applicable to mining and energy. Cuba receives assistance from a GEF-UNDP project on evaluation of technologies in the sugar cane energy sector and a UNDP project on photovoltaic energy and institutional strengthening in energy efficiency. Mexican research institutes are undertaking joint programmes with various countries to carry out technology development in the energy sector. Bilateral cooperation is also carried out with the United States Agency for International Development (USAID), the International Atomic Energy Agency (IAEA) and IEA.

G. Western Asia and the Middle East

99. The following nations have submitted reports to the Commission: Bahrain (1997), India (1997), Israel (1997, 2000), Lebanon (1997, 2000), Qatar (1997), and Saudi Arabia (1997). Those that have not submitted reports include Afghanistan, Bangladesh, Bhutan, Cyprus, Iran (Islamic Republic of), Iraq, Jordan, Kuwait, Maldives, Nepal, Oman, Pakistan, the Syrian Arab Republic, the United Arab Emirates and Yemen.

Decision-making

100. In India, a holding company of seven coal producing companies participates in implementing energy-related sustainable development programmes. Israel reported active involvement of the scientific and technical community in the decision-making process on energy. Business and industry and non-governmental organizations also participate as advisers through energy companies and the Israel Manufacture Association, the Israel Economic Forum for the Environment, Greenpeace, women's organizations and so forth. In Lebanon, consumer groups, scientists, non-governmental organizations and interest groups are considered technical references and advisers to projects related to protection of the atmosphere.

Legislation and regulations

101. In Israel, the Electricity Sector Law of 1996 replaced the exclusive concession of the Israel Electric Corporation with a system of supervision and licences, opening electricity generation to independent power producers for direct sale to consumers. The Abatement of Nuisances Law of 1961 is the principal legislative instrument controlling air pollution and regulating vehicle emissions, use of heavy fuel for household heating, and so on. New buildings are required to install solar water heaters, and comply with insulation standards for thermal comfort. The Operation of Vehicles Law regulates motor vehicle fuels. In Lebanon, laws on fuel derivatives, vehicle imports and operation, fuel taxes and so forth address energy-related issues. The "Energy Efficient Buildings" Project sets out complete energy codes and guidelines for buildings for energy efficiency.

Strategies and policies

102. India's energy objective is to improve efficiency in generation and use of energy, develop renewable energy technologies, conserve coal sources, and promote afforestation. Israel's primary goal is to ensure reliable and high-quality supplies of energy while preserving the environment, promoting alternative and renewable energy sources and energy conservation, and redefining the relationship between the Government and private enterprises. Its short-term and long-term objectives include diversifying energy supply by

expanding the use of natural gas, reducing energy consumption in buildings through a green building initiative, and imposing stringent regulations and control procedures for power generating facilities. Lebanon's priority in its energy strategy is to complete rehabilitation of its power plants, to ensure availability of electricity to all regions, and to improve transport system quality for reduced air pollution. Under its Five-Year Development Plan 2000-2004, Lebanon plans to promote use of domestic solar water heaters. Saudi Arabia's objectives under its Fifth Development Plan are to provide sufficient energy at appropriate cost, to conserve non-renewable energy resources, and to utilize clean renewable energy sources such as solar and wind.

Programmes

103. India has implemented programmes to install 12 million family-type biogas plants and 120 million improved cooking stoves for energy conservation, to recover energy from wastes, and to develop alternate energy sources for transportation such as tapping ocean energy. Israel has undertaken such programmes as "solar house" and "green building" initiatives in an effort to provide alternative energy sources to urban and rural households. Projects aimed at reducing greenhouse gas emissions include increasing the use of natural gas, upgrading power stations, waste and sludge treatment, cogeneration, and introduction of lead-free gasoline. Lebanon is preparing major energy conservation programmes such as the Investment Planning and Programming (IPP). The Climate Change Project has developed Lebanon's first national inventory of greenhouse gases, prepared a strategy to reduce greenhouse gas emissions, and assessed the country's vulnerability to climate change. Qatar has replaced large automobiles manufactured in the 1950s and 1960s with higher-efficiency vehicles with high-compression engines, using renewable and less polluting energy sources.

Status

104. Bahrain reported a decrease in oil dependence, which contributes to 56.4 per cent of state revenue, and a gradual increase in non-oil sectors. In India, coal accounts for over 60 per cent of the total energy resources used. Israel reported rapidly growing energy consumption, especially electricity. There was a significant decline in the levels of sulphur oxides and lead in the atmosphere, but an increase in emissions of CO_2, carbon monoxide (CO), NO_x, and hydrocarbons. Israel's economy is based on imported fossil fuels, especially oil, owing to very limited energy resources. The significant gas reserve that has been recently discovered is expected to reduce both the costs and environmental damage of electricity generation. Lebanon is a heavy importer of energy sources, importing more than 97 per cent of fossil fuel. Electricity provision is considered insufficient and costly. The Lebanese solar sector has seen a recent decline owing to a negative consumer attitude and high taxes imposed on the industry. In Qatar, oil accounts for 85 per cent of the country's export earnings and 75 per cent of government revenues. Its gas reserves amount to 30 per cent of the world's total, but Qatar consumes only 5 per cent of the amount consumed globally. Saudi Arabia reported reduced content of lead in gasoline owing to strict environmental standards applied to existing local refineries.

Challenges

105. In India, CO_2 emissions are a major concern. Israel has identified environmental degradation caused by energy consumption, especially transportation, electricity generation, and industrial activities, causing atmospheric pollution and water contamination. It cited public dominance in energy production as a structural barrier against development and use of renewable energy sources and cleaner fossil fuel techniques. Other barriers cited include insufficient government allocations for R&D and lack of economic incentives for developing and using clean energy sources. Lebanon, as a major importer of energy sources, reported a serious vulnerability to changes at the global level, especially international oil prices. It also reported particularly elevated ozone concentrations in urban areas owing to vehicle emissions, and stressed negative impacts of increased pollution levels on respiratory and cardiovascular health, and social and economic conditions. Lebanon cited various barriers against the development of renewable energy sources, including information barriers, awareness barriers, institutional barriers such as lack of a responsible entity or policy, capacity and technical barriers such as lack of know-how, and financial barriers such as lack of finances, of investment incentives, and of a services market.

Capacity-building

106. Israel operates an advisory office and a toll-free telephone number for advice on energy conservation, and provides technical consulting and guidance. Special days and weeks are dedicated to subjects such as green transportation, air pollution abatement and green building. Thirty-five environmental education and information centres have been established throughout Israel. Education targeted at professionals includes the establishment of advisory services for plants and institutions, workshops for energy conservation officers and professional literature on subjects. An energy conservation curriculum programme is in place for fifth to seventh grades, and a Green Audit Kit has been developed for schools and kindergartens. Lebanon reported a limited existence of public awareness programmes, citing Green Light activities as an example alerting to the adverse effects of fuel use. Energy and natural resources issues are treated in Lebanon's primary and secondary education.

Information

107. Israel prepares annual estimates on the country-wide quantities of pollutants emitted into the atmosphere from fuel combustion, and compiles and analyses information on several energy-related issues. Information on energy is disseminated mostly by government publications and through the Internet. An air quality index is published in the press and the media plays a role in publishing information on energy-related issues in general. In Lebanon, energy-related information is provided by government ministries and universities through conferences, government reports, seminars, web sites and public libraries. There exists no monitoring mechanism for pollution levels.

Research and technologies

108. India reported use of compressed natural gas (CNG) for electricity generation, solar photovoltaic systems, and bagasse-based cogeneration. Demonstration projects have been undertaken in biomass-based power generation. Israel reported the greatest progress having been made in wind and solar energy technologies, with most homes in the country using solar water heating and thereby reducing national fuel consumption by 3 per cent. An industrial consortium (CONSOLAR) was established to develop concentrated solar energy technologies aimed at future commercial applications. A technology based on both wind and solar energy named the "energy tower" has been developed, and plans for light rail within cities and improved inter-urban train service are being advanced with a view to improving fuel efficiency and promoting a cleaner environment. In Lebanon, joint research efforts are under way to find the best means to introduce and apply renewable energy technologies. Saudi Arabia reported achievements in collection and treatment of the natural gas accompanying the production of crude oil, which have the positive impact of eliminating almost all emissions from combustion of huge quantities of gases saturated by sulphur.

Financing

109. In Israel, financing of energy-related projects is provided mostly by public sources. Private companies fund energy-related projects in the fields of solar energy and geothermal energy. To some extent, bilateral agreements on the environment with such countries as Germany and the United States allow for partial financing of projects by these countries. In Lebanon, funding for energy-related projects comes from the national budget and foreign sources such as EU, UNDP, GEF and so forth.

Cooperation

110. Israel reported bilateral cooperation with the United States, Germany and Australia, promoting transfer of energy-related technologies through international courses on energy management and conservation in developing countries, installation of Israeli technology-based solar power and clean power plants, and solar research activities. Cooperation also exists at the university level with the United States, Western Europe and Australia. Israel also reported full compliance with the Montreal Protocol on Substances that Deplete the Ozone Layer, and multilateral cooperation with the United Nations Framework Convention on Climate Change. Lebanon reported a high level of multilateral cooperation with GEF, le Fonds Français pour l'Environnement Mondial (FFEM), UNDP, the African Development Bank and other international funding agencies, with regard to formulating energy policies, research, and technology transfer in addition to capacity-building. Lebanon also reported fulfilment of its obligations under the Kyoto Protocol and the Montreal Protocol.

H. Eastern Asia

111. The following countries have submitted reports to the Commission: Indonesia (1997), Japan (1998, 2000), the Philippines (1998), the Republic of Korea (2000), Singapore (1998), Sri Lanka (1997), and Thailand (1997, 2000). Those that have not reported include: Brunei Darussalam, Cambodia, China, the Democratic People's Republic of Korea, the Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar and Viet Nam.

Decision-making

112. In Japan, non-governmental organizations and consumers influence energy consumption through an environmental bookkeeping accounting campaign, and businesses have formed a voluntary action plan to conserve energy and reduce CO_2 emissions. The Republic of Korea reported nationwide activities of a partnership movement known as Green Energy Family, made up of citizens, companies, non-governmental organizations, and the press, and concerted efforts of the government and the Citizen's Coalition for Energy Conservation. Singapore has organized a national inter-agency committee on energy efficiency comprising government ministries, statutory boards and academia. Thailand has established the National Energy Policy Council (NEPC) to cope with the changing energy situation.

Legislation and regulations

113. Japan, the Philippines and the Republic of Korea reported use of such incentive measures as tax exemptions and deductions, government loans and subsidies to reduce vehicle emissions and promote higher energy efficiency in the transport sector. In Singapore, the Building Control Regulation stipulates energy conservation measures. Thailand has adopted tax exemption measures for investment in energy saving equipment, and has legislated various standards and regulations governing factory emissions, the quality of oil, pollution levels, fuel storage safety, electricity distribution and so on.

Strategies and policies

114. Indonesia engages relatively little in direct management of energy efficiency. However, efforts have been undertaken in the search for new policy instruments. Japan's Basic Environment Plan aims to increase energy efficiency in production processes, promote use of new and renewable sources and environmentally sound technologies, and increase awareness in respect of sustainable consumption. The objective of the energy policy of the Philippines is to achieve the country's long-term self-sufficiency while implementing environmental safety and protection measures in development projects. The Republic of Korea's goals for the energy future include reaching renewable energy use of 2 per cent of total energy consumption by 2006, building 1 million energy-efficient homes in the next 10 years, providing 1 million households with combined heat and power by 2002, and signing a voluntary agreement with 600 energy-intensive industries by 2003. Singapore's energy policy objectives include letting the market determine efficient energy prices, incorporating energy conservation standards in building designs, encouraging smaller, high-efficiency vehicles and public transport, and diversifying energy supplies through the use of natural gas. Sri Lanka's key priority is to develop alternative energy sources. Principal elements in Thailand's sustainable energy strategy include exploration and development of domestic petroleum resources, implementation of energy conservation measures, promotion of use of renewable and by-product energy and recycling, and research and development for energy efficiency.

Programmes

115. Indonesia has implemented programmes to replace kerosene with gas and electricity, and to make environmental impact assessment for power projects obligatory. Japan reported having taken measures to develop clean energy vehicles and photovoltaic power generation. "Zero-Emission" industrial complexes and the initiation of the "Ecotown Pilot Project" have also been implemented. The Philippines conducted demonstration projects on new and renewable energy systems under the Affiliated Non-Conventional Energy Centre Programme, which includes installation of solar home systems, PV streetlights, PV refrigerators, PV water pumping stations, biogas systems, micro-hydro systems and windmills. The Republic of Korea has implemented a Local Energy Programme consisting of an Infrastructure Build-Up Programme and a Demonstration Project, to promote installation of facilities using renewable energy such as PV and wind power. Other focus areas include expansion of combined heat and power and the Energy Saving

Performance Contracting Programme. Thailand has implemented a National Energy Conservation Programme to reduce greenhouse gas emissions, comprising compulsory, voluntary and complementary programmes aimed at 10 main projects. The Renewable Energy Project promotes biogas production using pig manure, power generation using PV cells for schools outside the grid, and solar energy use. The Biomass Energy Promotion Project focuses on the use of agricultural wastes and solar energy aimed at supplying energy to low-income households. The Natural Gas for Vehicles Programme and Hybrid Vehicle Project are undertaken to reduce emissions from petroleum-based fuels.

Status

116. Indonesia reported an annual energy use increase of 9.5 per cent, as compared with a 2 per cent global increase and a 4 per cent increase among Association of Southeast Asian Nations (ASEAN) member countries. The industrial sector consumes most of the energy produced, followed by the transportation sector. Japan reported diversification of its energy sources, with growing shares of nuclear and natural gas. The Republic of Korea reported drastic reduction in the use of firewood and growth in the use of liquefied natural gas (LNG) and nuclear energy. Sri Lanka reported increasing energy consumption. Thailand reported a reduction in oil imports, increased use of natural gas for power generation, expecting an increased demand for natural gas and coal in the next decade and a decreased share of petroleum and renewable energy.

Challenges

117. Indonesia reported a need to adopt stringent emission standards and selective production technologies. Japan reported a need for immediate attention on high concentration of NO_x and suspended particulate matter, and cited comparatively higher costs of renewable energy sources as solar energy and wind energy as a major challenge in respect of introducing them to households and remote areas. The Republic of Korea cited such difficulties as locating nuclear waste disposal sites and hydropower projects, and making renewable energy economically feasible compared with conventional fossil fuels. Singapore depends almost entirely on energy imports, and the potential for increasing energy supply through renewable energy sources is relatively small. Thailand reported on the negative impact of climate change on the country's water resources supply and its vulnerability to socio-economic effects, requiring further research. Thailand also cited various barriers to utilizing renewable energy resources, including inadequate number of skilled field personnel and lack of training, insufficient information, high market development cost, and limited budget.

Capacity-building

118. Indonesia reported enhanced public understanding of social, economic and environmental impacts of energy use. Japan conducts promotional activities disseminating information on the United Nations Framework Convention on Climate Change and the Kyoto Protocol to the Convention. The "Eco-Drive" Programme promotes public awareness of automobile efficiency. The Republic of Korea reported engaging in various public campaign activities such as producing visual aids, promotional hats and banners, and running television, newspaper, and radio ads to stimulate interest in energy efficiency and conservation. Other measures include the annual Energy Conservation Exhibition (ENCONEX), "Energy Conservation Day", the biennial Energy Conservation Convention, the Energy Pavilion, and "Demonstration Energy Conservation Schools". Singapore has implemented the Green Label Scheme, the annual "Clean and Green" week, and other energy campaigns and exhibits to promote efficient energy use. Energy management courses, workshops and seminars are organized primarily for technical staff and professionals. Thailand has implemented a Public Relations Programme aimed at energy saving under the "Divide By Two" campaign, which uses the media to promote energy saving and engages in community-oriented activities. The "Dawn Project" integrates energy conservation and environmental studies in 600 primary and secondary school curriculums nationwide, while the Human Resources Development Project provides energy conservation courses at the university level, seminars and training for energy managers, consultants and technicians.

Information

119. In Japan, the Survey on Transport Energy is published by the Government and made available to the public. The Philippines conducts energy audits in commercial, industrial and transport sectors. The Republic of Korea engages in collection, analysis,

processing and dissemination of energy information through the Internet, personal computer (PC) communication networks, and various publications. A month-long Energy Cyber Adventure was held on the Internet, with 30,000 people participating in various events such as an energy conservation quiz, games and so on, aimed at drawing public attention to energy conservation. Singapore makes available energy audits and surveys of industry sectors and energy balance data to decision makers through various reports and publications, and plans to develop benchmarks on electricity usage to inform consumers of efficient energy use. Thailand conducts annual publications on the country's energy and oil situations, and publishes quarterly "Energy Journals". Such information is made available to the public through the Government web site.

Research and technologies

120. Japan reported technological advancements in solar batteries, wind power generation, gasification and liquefaction of wood biomass, waste-water treatment, high sugar producing crops, and cogeneration systems. Research and development for reduction of greenhouse gas emissions and fuel efficiency include compressed natural gas vehicles, fuel cell vehicles, the monorail, and light rail transit. The Republic of Korea reported successful commercialization of solar thermal water heating units and use of municipal and industrial wastes. High priority is placed on research and development efforts in the areas of solar thermal energy, photovoltaic power systems, fuel cells, and the integrated gasification combined cycle (IGCC). Thailand reported progress in applying biomass technology through a pilot phase of five to seven years, initiating the installation and expansion of the solar energy system, and implementation of a biogas project for power generation on livestock farms. Also, natural gas vehicles and hybrid vehicles are being developed as new modes of transportation.

Financing

121. Japan allocated 74.8 billion yen to introducing new energy in fiscal year 1998. The Republic of Korea provides long-term and low-interest rate loans from the Fund for the Rational Use of Energy to energy efficiency and conservation investments. Singapore recently began to allow private sector investment in development and operation of power plants. Activities related to climate change and sea-level rise are financed by the individual developers, most of whom have their own source of funding. Thailand's Energy Conservation Promotion Fund provides subsidies to government agencies, State enterprises, educational institutions and private organizations, to be used for energy conservation programmes. Its sources include the Petroleum Fund, and domestic remittances from gasoline, kerosene, diesel and fuel oil.

Cooperation

122. Japan reported active bilateral cooperation with developing countries, through official development assistance (ODA), research, training programmes related to power generation and transmission facilities management, renewable energy, mining, and oil refinement technologies. For example, Japan and the Philippines cooperate on transfer of technology for pollution control and energy efficiency (the Green Aide Plan). Japan also makes financial contributions to GEF and the Asian Development Bank, and provides "Grant Aid for Clean Energy" to developing countries in support of the use of renewable energy sources. Singapore reported cooperation with the Energy Working Group of Asia-Pacific Economic Cooperation (APEC), and the ASEAN Energy Ministers' Forum. The Republic of Korea reported bilateral cooperation for exchange of information and staff, training programmes, and joint research projects with the Energy Conservation Centre of Japan (ECCJ), the New Energy and Industrial Technology Development Organization (NEDO), the Department of Energy (DOE) and the Agency for the Environment and Energy Resources (ADEME). It also reported active participation in IEA programmes, energy cooperation in APEC and participation in the United Nations Framework Convention on Climate Change. Thailand reported bilateral technology transfer cooperation with Germany through the "Biogas Production from Livestock Farms" project and with Australia through the "Centrally Heated Bulk Caring System" project. For research and development cooperation, Thailand participates in regional meetings and workshops organized by the APEC New and Renewable Energy Technologies Expert Group Meeting and the Canadian International Development Agency (CIDA), involving the Lao People's Democratic Republic, Viet Nam and Cambodia. Thailand cooperates multilaterally with APEC, ASEAN, the Bangladesh-India-Myanmar-Sri

Lanka-Thailand Cooperation Forum, and the Mekong River Commission.

I. Oceania and the Pacific

123. The following countries have submitted information to the Commission: Australia (1998), New Zealand (1997, 2000), and Tonga (2000). Those countries that have not submitted information include Fiji, Kiribati, the Marshall Islands, Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tuvalu and Vanuatu.

Decision-making

124. New Zealand is committed to involving all sectors of the community and economy in the decision-making process, through public consultations and submission of reports, for substantive input. In Tonga, women are required to participate in village committees that have been delegated the authority to manage the technical and financial matters concerning solar lighting projects. Private businesses and non-governmental organizations are encouraged to participate in formulating and planning strategies for energy sector management and solar energy projects.

Legislation and regulations

125. New Zealand has implemented various energy-specific statutes and regulations such as the Energy Efficiency and Conservation Act (2000) and Electricity Regulations (1999) to regulate all energy-related activities. New Zealand is undertaking wide-ranging regulatory reforms to keep market distortions to a minimum. Energy efficiency is explicitly regulated under the Building Act, and minimum energy performance standards and mandatory labelling are to be applied to household appliances. Tonga employs duty exemptions for oil used for power generation and government-provided solar hardware for remote islands.

Strategies and policies

126. Australia has taken major actions to reduce greenhouse gas emissions since 1992, under its National Greenhouse Response Strategy. A key environmental agenda is to reform energy markets, to improve the existing delivery of energy services, to reflect the real costs of energy provisions, and to allow efficient competition for new and innovative energy technologies. New Zealand has recently completed its Energy Policy Framework, whose objectives include increasing funding for the Energy Efficiency and Conservation Authority to deliver programmes aimed at promoting energy efficiency and renewable energy, developing consumer labelling and upgrading energy performance standards for buildings and appliances, ensuring environmental objectives and secure supplies through various electricity reforms, enhancing competition in the gas sector, and implementing a Vehicle Fleet Emission Control Strategy to improve air quality and reduce greenhouse gas emissions. Tonga's short-term energy goal is to improve the electricity accessibility to low-income families on priority islands, through renewable technology. Its long-term energy strategy is aimed at self-sufficient and sustainable energy supply for the rural areas, improving efficiency techniques in energy-intensive commercial activities under conservation principles, and achieving a balance of renewable and non-renewable energy consumption.

Programmes and projects

127. To reduce greenhouse gas emissions, New Zealand has implemented such programmes as Energy-Wise Business, Energy-Wise Homes, Energy-Wise Information, Energy-Wise Government, the Crown Energy Efficiency Loan Scheme, and the Energy Saver Fund Grant Scheme. Programmes aimed at reducing transportation emissions include providing fleet management guidelines and driver education brochures, tip sheets and video. In Tonga, electrification projects are carried out to provide lighting and solar refrigerators for remote islands. The Utility Demand Side Management Programme is aimed at compiling an inventory of greenhouse gases, analysing potential measures to abate greenhouse gas emissions, and preparing a national action plan. Rehabilitation of diesel power generators has been carried out at the local level to increase machine efficiency. Programmes aimed at reducing vehicle emissions include restricting import fuel-inefficient vehicles, vehicle tuning, importation of unleaded fuels, promotion of carpooling, and requiring annual and quarterly fitness tests for all vehicles.

Status

128. Australia reported emergence of a robust and competitive energy market, where retailers have begun

providing integrated package services, such as energy efficiency and smart metering. There is renewed interest among suppliers in cogeneration and remote area power system projects. New Zealand reported a high rate of renewable resources use, with hydropower producing 70-75 per cent of annual electricity needs and geothermal power contributing 7 per cent. It reported a relatively moderate increase in energy use of 11.5 per cent between 1991 and 1996, as compared with a GDP increase of 16.9 per cent and a population increase of 9 per cent during the same period. New Zealand has been moving towards a completely open market, through corporatization and privatization. Tonga reported a rapid recent development of main commercial centres and growing demand for energy by the residential sector. Also, an increased number of imported vehicles has also escalated the demand for petrol import, from 15 per cent in 1994 to 19 per cent in 1998, of which 80 per cent is consumed by the transportation sector.

Challenges

129. New Zealand's barriers against development and use of renewable energy resources include fixed price charging, unclear market signals regarding the cost of CO_2 emissions, lack of investment in renewable R&D, lack of development finance and venture capital, the high cost of protecting intellectual property, and lack of information about renewable energy and government policy options. Tonga reported extensive environmental degradation in land and air quality owing to energy consumption. It cited lack of coordination among energy authorities, lack of appropriate policies reflecting real energy prices, and absence of regulations for certain activities as barriers against development and usage of renewable energy sources.

Capacity-building

130. New Zealand launched an "Energy-Wise Companies Campaign" to promote commitment towards energy efficiency among business management, and to establish effective partnership between the Government and the private sector. The country's energy authority has made available an energy-focused resource kit for secondary schools entitled "Precious Joules", and a private sector company markets an energy curriculum resource kit for primary schools which is distributed to schools with the assistance of line energy companies and trusts. In addition, a wide range of publications, web sites, and seminars on energy efficiency and climate change issues are made available to the public. Tonga has taken such measures as on-the-job training and workshops for technicians, and media campaigns including regular radio programmes, publication of leaflets and television spots targeting consumers, to promote public awareness of energy and environment issues.

Information

131. New Zealand and Tonga reported collection and compilation of statistical information on energy supply and demand and greenhouse gas emissions, and dissemination of such information through web sites, media and various publications.

Research and technologies

132. New Zealand reported a limited number of energy efficiency and renewable energy technologies being developed to reduce greenhouse gas emissions and promote cleaner production, including the Smart-Drain heat exchanger which recovers energy from wastes, and wool-based insulation. Tonga reported accelerated progress in utilization of solar energy for heating and lighting in remote islands, and research activities for wind potential and biomass resource assessment.

Financing

133. New Zealand had allocated NZ$ 8.45 million over a three-year period since 1994 for specific measures targeted at improving energy efficiency. Its Energy Saver Fund, set up in 1994-1995, also provides NZ$ 18 million to promoting energy efficiency in the residential sector. Tonga receives about 80 per cent of the funding necessary for its energy projects from outside donors, especially from the Asian Development Bank, EU, France, Australia, New Zealand, Japan, the Forum Secretariat, the South Pacific Applied Geoscience Commission (SOPAC), the South Pacific Commission (SPC), UNDP, the South Pacific Regional Environment Programme (SPREP) and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Cooperation

134. New Zealand reported full implementation of its obligations under the Montreal Protocol. Tonga

receives funding from EU, New Zealand, Australia, France and the Japan International Cooperation Agency (JICA) for solar electrification of its remote islands. Tonga participates in the Pacific Island for Climate Change Assistance Programme aimed at meeting reporting requirements under the Kyoto Protocol, and the Pacific Regional Energy Assessment Project 2001 aimed at assessing barriers against renewable energy initiatives. UNDP has approved funding for Tonga to prepare its first national report to the United Nations Framework Convention on Climate Change.

III. Challenges for the energy future

A. Regionally recognized environmental problems

135. Most commonly recognized environmental degradation problems related to energy production and consumption are as follows.

Eastern Europe and CIS

136. Most countries reported environmental problems resulting from energy use, especially air and water pollution.

Western Europe

137. Some countries in the region reported concerns over continued greenhouse gas emissions especially from the transport sector.

Northern Africa

138. Many countries reported serious deforestation as the result of heavy dependence on fuelwood for energy. Some countries cited continuing emissions from diesel power plants and sludge from use of heavy fuel oil for power generation as major sources of pollution.

Southern Africa

139. Most countries still depend heavily on fuelwood for cooking and heating, which causes deforestation around settlements.

North America (information based on only one country)

140. The growing population and export-oriented and resource-dependent economy are causing difficulties in reducing greenhouse gas emissions.

Latin America and the Caribbean

141. Countries have identified as a major concern air pollution caused by transport and industrial sectors and from the use of fuelwood and coal in rural areas. Deforestation and loss of biodiversity have been cited as the direct result of fuel consumption and coal mining. One country also reported water contamination due to mishandling of toxic wastes from electricity generation.

Western Asia and the Middle East

142. Environmental degradation from the transport sector, electricity generation, and industrial activities is a major concern for the region. Some countries reported water contamination, health hazards from air pollution, and elevated ozone concentrations in urban areas as serious challenges.

Eastern Asia

143. Among the environmental problems reported by countries in the region are a high concentration of NOx and suspended particulate matter, and the negative impact of climate change on water resources supply.

Oceania and the Pacific

144. Tonga reported extensive environmental degradation in land and air quality due to energy consumption.

B. Regionally recognized barriers against sustainable energy

145. Most commonly recognized barriers against use of renewable sources and energy-efficient technologies are as follows.

Eastern Europe and CIS

146. Lack of incentives to use energy-efficient technologies and continuing economic expansion were cited as major challenges to reduction of greenhouse gas emissions. Some countries reported budgetary constraints, outdated technology, and lack of foreign investments as barriers against introducing renewable energy sources.

Western Europe

147. Challenges reported by some of the countries in the region include difficulties in the coordination of policies between the central and local governments and with EU, increasing pressure to reduce State budgets and personnel, centralized energy production system, limited funding, and the relatively high cost of renewable energy sources.

Northern Africa

148. Many countries commonly cited lack of coherent energy policy as a major barrier against energy efficiency. Other common constraints include lack of technological know-how, insufficient finance for capital-intensive energy projects, and lack of public understanding or information on issues related to energy and environment. One country reported the need to improve participation by major groups in decision-making.

Southern Africa

149. Challenges cited by some of the countries include absence of laws encouraging alternative energy sources, insufficient government financing of energy-related projects, and limited success in rural electrification due to financial constraints.

North America (information based on only one country)

150. There is pressure from globalization and industrial restructuring on the Government to exercise its responsibilities in a different manner. There are needs for further R&D activities on cleaner fossil fuel techniques.

Latin America and the Caribbean

151. Some of the challenges commonly identified by countries in the region include lack of technologies to exploit abundant renewable resources, high risks involved in the initiation of wind and solar energy use for electricity generation, and insufficient training of field personnel.

Western Asia and the Middle East

152. Countries in the region cited public dominance in energy production and lack of economic incentives for renewable resource development as major structural barriers against improving energy efficiency. Oil importing countries pointed out vulnerability to international oil prices. Other challenges included insufficient information, lack of public awareness, and financial constraints.

Eastern Asia

153. Challenges identified in the region include need for more stringent standards for emission and production technologies, relatively high cost of renewable energy sources, heavy dependence on energy imports, insufficient information and training, and limited budgets.

Oceania and the Pacific

154. Challenges identified by countries in the region include lack of investment in renewable R&D, lack of development finance and venture capital, unclear market signals, lack of appropriate policies reflecting real energy prices, lack of policy coordination among energy authorities, and insufficient information on renewable sources.

Notes

[1] See *Official Records of the Economic and Social Council, 1999, Supplement No. 9* (E/1999/29), chap. I, sect. C.

[2] Ibid., *1998, Supplement No. 9* (E/1998/29), chap. I, sect. B.

[3] *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference* (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

[4] General Assembly resolution S-19/2, annex, appendix.

[5] Regional group of four power companies: ČEPS a.s. (Czech Power Transmission System Company), Magyar Villamos Mürek, Polskie Sieci Elektroenergetyczne and Slovenské elektrárne.

[6] FCCC/CP/1997/7/Add.1, decision 1/CP.3, annex.

[7] A/AC.237/18 (Part II)/Add.1 and Corr.1, annex I.

Annex

Summary of findings

Region	*Energy supply and consumption*	*Key strategies and policies and programmes*	*Major group and public awareness*	*Information*	*Technology research and development*	*Cooperation*	*Major challenges*
Eastern Europe and CIS	Reduced coal consumption Growing use of natural gas, biomass, hydro energy and geothermal energy	Recent establishment/ revision of laws and regulations concerning energy pricing, emission limits and tax measures Introduction of renewable resources Minimizing energy consumption and pollution Reduction of greenhouse gas emissions	Increased involvement of non-governmental organizations in decision-making Increased role of private sector in energy production Limited public awareness-raising programmes	Limited and selective collection of information Limited availability of energy-related information to public	R&D concentrated on alternative energy technologies	Active bilateral cooperation with Western European countries and United States and Japan Participation in EU programmes and regional energy networks	Air and water pollution from energy production Lack of incentives for energy-efficient technologies Budgetary constraints Outdated technology
Western Europe	Near 100 per cent accessibility to electricity General decline in total energy consumption since 1990 Significant improvements in energy efficiency Greater share of natural gas use and less of coal consumption	Widespread use efficiency standards and regulations on heating, home appliances, and vehicle emissions Widespread use of tax measures, subsidies and other fiscal incentives to promote energy efficiency Policies focused on energy market liberalization, diversification of	Active involvement of major groups in decision-making Major contributions by non-governmental organizations and expert groups in meeting national energy goals Popular use of training programmes, campaigns, information booths for public awareness-raising	Widespread use of publications, brochures, guides, and the Internet for public access to energy-related information Development of statistical databases and information systems in some countries	Continued R&D activities on renewable energy sources and reduction of negative environmental impact Significant technological advances in most countries, especially in the use of solar and biomass energy, alternative motor fuels etc.	Active multilateral cooperation with EU, GEF, the Kyoto Protocol, UNDP, UNEP, IEA and other regional energy networks Active bilateral cooperation with developing countries and Eastern European countries in technology transfer, capacity-building, and joint R&D	Concerns over continued greenhouse gas emissions especially from the transport sector Difficulties in policy coordination Pressure to reduce public budgets Relatively high cost of renewable energy sources

Region	Energy supply and consumption	Key strategies and policies and programmes	Major group and public awareness	Information	Technology research and development	Cooperation	Major challenges
Western Europe (*continued*)		sources, promotion of renewable resources, and reduction of greenhouse gas emissions, especially CO_2					
Northern Africa	Heavy dependence on fuelwood and petroleum for energy supply Need for expansion of electricity grid to rural households Initiation of privatization of the energy sector	Limited use of taxes as incentives for energy conservation and efficiency Development of solar, wind, hydro and biomass as energy sources Improving energy access to urban and rural households Expanding electricity Introducing enhanced home appliances	Limited participation by major groups in energy decision-making Plans under way for awareness-raising programmes	Growing public access to energy-related information through web sites Information on energy collected by State agencies	Introduction of hydro and solar energy Technological R&D activities limited to certain countries	No specified bilateral cooperation project Limited multilateral cooperation with UNIDO, GEF and West Africa Power Pool Project	Serious deforestation and pressure on forestry resources Lack of technological know-how and finances Lack of information
Southern Africa	Varying degree of electricity supply between countries and regions Heavy dependence on fuelwood for energy in most countries	Common emphasis on the use of renewable energy sources, especially solar energy Priority on providing electricity to rural areas and distributing fuel-efficient stoves	Major group involvement very scarcely mentioned Initiation of various public awareness-raising programmes using media, workshops and campaigns in certain countries	Market surveys and consumer behaviour research conducted by a few countries	Development of unique biotechnologies in certain countries, such as United Republic of Tanzania's "Takagas" Research centres built in several countries for R&D in renewable energy sources	Little mention of bilateral cooperation with a developed country Cooperation projects with SADC energy management project, GEF and UNDP in certain countries	Serious deforestation around settlements Unsuccessful electrification of rural areas Financial constraints Absence of laws encouraging renewable sources

Region	*Energy supply and consumption*	*Key strategies and policies and programmes*	*Major group and public awareness*	*Information*	*Technology research and development*	*Cooperation*	*Major challenges*
North America	Increased energy consumption and greenhouse gas emissions Energy efficiency improvements in most industries	Recent changes in tax system to promote energy efficiency and conservation Promotion of competitive energy market Programmes aimed at reducing vehicle emissions and encouraging use of renewable energy sources	Increasing participation by civilians and municipal governments in energy decision-making Use of various educational programmes, information kits, media and events for awareness-raising and training	Active management of statistical databases publications and web sites related to energy information	Important developments in cleaner fossil fuel technologies Research efforts under way in hydroelectric facilities, biomass conversion, alternative transportation fuels etc.	Multilateral cooperation with the Climate Technology Institute, International Energy Agency, EU, APEC Bilateral cooperation among Canada, the United States and Mexico	Pressure from globalization and industrial restructuring on the government to exercise responsibilities differently Needs for further R&D on cleaner fossil fuel techniques
Latin America and the Caribbean	Increased use of renewable resources, especially solar and hydropower Increased energy conservation efforts High potential for development of biogas, wind and biomass energy	Promotion of renewable energy sources adopted as common energy policy Strategies to privatize energy supply, increase market competition and break monopoly Programmes aimed at expanding electricity and increasing use of natural gas, development of wind, hydro and solar energy, and atmospheric control	Regular and active involvement of major groups in decision-making reported by most countries Active promotion of public awareness on energy through campaigns, school education and on-the-job training	Systematic collection and management of information on energy production and supply in most countries Information made widely available to public through web sites, publications etc.	Achievements reported by certain countries in refrigeration systems, advanced carbonous materials, thermal energy performance, energy generation from sugar cane biomass, hydropower and nuclear energy	Active regional cooperation mechanisms, such as Latin American Energy Organization, Caribbean Energy Action Programme, and San Jose agreement Financial assistance from UNDP and GEF Limited bilateral cooperation reported	Air pollution, deforestation, loss of biodiversity and water contamination resulting from fuel consumption, electricity generation, and coal mining Lack of renewable energy technologies High risks involved in initiation of solar and wind energy use Insufficient field training

Region	Energy supply and consumption	Key strategies and policies and programmes	Major group and public awareness	Information	Technology research and development	Cooperation	Major challenges
Western Asia and the Middle East	Increasing energy consumption reported in several countries Widely varying energy production and consumption patterns Differing use of renewable resources according to countries	Vehicle emission regulations, fuel taxes, efficiency guidelines for buildings imposed in certain countries Common energy policy to develop renewable energy technology, and to ensure better energy supply to all regions Programmes for energy conservation and environment protection implemented in a number of countries	Participation by non-governmental organizations, scientists and businesses encouraged in most countries Public awareness-raising programmes and capacity-building measures reported in only one country	Systematic collection and management of energy-related information reported by only one country	Significant achievements in utilization of compressed natural gas for electricity generation, solar and wind energy, and biomass cogeneration Continued research efforts under way on renewable energy sources	Active bilateral cooperation between certain countries in the region with the United States, Germany, Australia and France in technology transfer, joint R&D and financial support Active multilateral cooperation with EU, UNDP, GEF, FFEM and the African Development Fund	Serious air pollution, health hazards and water contamination reported Public sector dominance in energy production Vulnerability to fluctuations in international oil prices Lack of economic incentives for renewable energy development
Eastern Asia	General increase in energy consumption due to industrial expansion and growing demand from transportation Increased use of natural gas in some countries	Use of air pollution regulations, efficiency standards, emission limits, and tax incentives in several countries Common energy policy to develop renewable energy sources and diversify energy supplies Programmes promoting natural gas in place of kerosene.	Establishment of special coordination agencies and involvement of non-governmental organizations, business groups, and academia reported by several countries Wide implementation of awareness-raising projects and campaigns in most countries	Energy surveys and audits conducted in a number of countries Information made available through government publications and the Internet	Advances in solar batteries, wind power generation, wood biomass, natural gas vehicles etc. in certain countries including Japan, the Republic of Korea, and Thailand	Various bilateral cooperation projects reported involving Japan, the Philippines and the Republic of Korea, and between Thailand and Germany/ Australia Active interregional cooperation involving APEC, ASEAN, Mekong River Commission etc.	High concentration of nitrogen oxides Negative impact of climate change on water supplies Need for more stringent emission standards High cost of renewable energy projects Insufficient information and training

Region	*Energy supply and consumption*	*Key strategies and policies and programmes*	*Major group and public awareness*	*Information*	*Technology research and development*	*Cooperation*	*Major challenges*
Eastern Asia (*continued*)		environmental impact assessment, solar generation and biogas production					
Oceania and the Pacific	Emergence of an open and competitive energy market in Australia and New Zealand Dominant renewable energy use in New Zealand Increased demand for energy and petroleum import reported by Tonga	Reforms in the energy sector under way in Australia and New Zealand, to reflect real energy costs and allow competition for renewable energy Plans for consumer labelling and efficiency standards upgrading in New Zealand Priority set on improving energy accessibility in Tonga	Non-governmental organizations, consumers, businesses and village committees strongly encouraged to participate in decision-making A variety of awareness-raising projects and campaigns in place	Compilation and dissemination of statistical information on energy supply and greenhouse gas emissions through publications and web sites	Limited technological developments in residential power generation heating, wool-based insulation etc. Progress made in use of solar energy for heating and lighting in remote islands	Active cooperation reported by Tonga with Australia, New Zealand, Japan, France, EU, UNDP, UNESCO etc., especially in financial support for energy projects	Lack of renewable R&D investment, lack of appropriate policies reflecting real energy prices, lack of policy coordination among energy authorities